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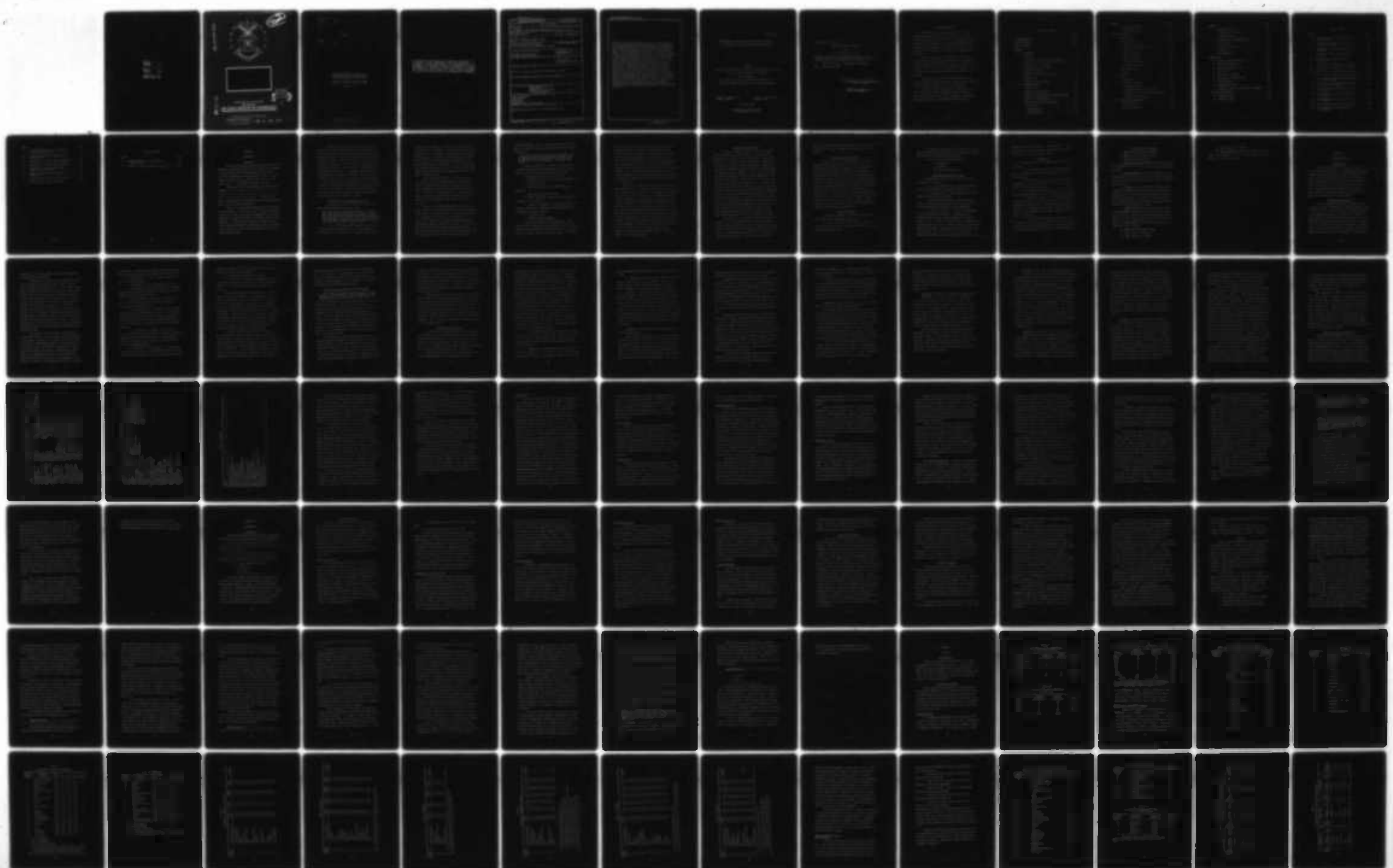

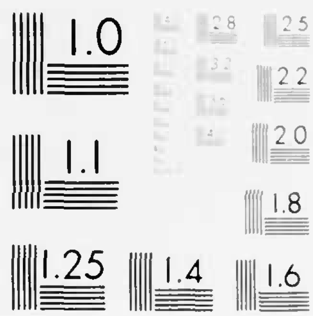
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DEPARTMENT OF THE AIR FORCE
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AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

DEVELOPMENT OF AN ORGANIZATIONAL
EFFECTIVENESS MODEL FOR BASE LEVEL
CIVIL ENGINEERING ORGANIZATIONS

Richard D. McKnight, Captain, USAF
Gregory P. Parker, Captain, USAF

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Because no common definition of base civil engineering (BCE) organizational effectiveness existed, the assessment of and improvement in the effectiveness of BCE organizations has been difficult. At the request of the Air Staff, this research developed an organizational effectiveness model for use by base civil engineers. A census survey (with a return rate of 83.3%) of CONUS wing, base, and civil engineering commanders was used to evaluate the importance of thirty-seven suggested criteria and to identify other criteria considered important by respondents. By a judgemental analysis, thirty-three criteria were selected to define organizational effectiveness within base civil engineering. Significantly, all respondents considered leadership to be the most important criterion in defining organizational effectiveness within civil engineering. A functional model develcped through content analysis grouped these criteria into nine factors: fire protection, leadership, readiness, resource availability, organizational health, program management, contract management, operations workforce performance, and customer image. The resulting model allows base civil engineers to evaluate their organizations' effectiveness as perceived by their commanders. Differences in the model based upon the respondents' positions, major air commands, and base sizes are discussed. Recommendations to validate and implement the model are also presented.

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DEVELOPMENT OF AN ORGANIZATIONAL EFFECTIVENESS MODEL FOR BASE LEVEL CIVIL ENGINEERING ORGANIZATIONS

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

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In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Engineering Management

By

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and

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has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

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CHAPTER I

INTRODUCTION

Overview

For several decades, economists, general management theorists, operations researchers, and others have attempted to model organizational effectiveness (Cummings, 1981). In the 1980s, organizational effectiveness is still a fundamental management issue: Albanese (1981) calls it "the bottom line, . . . the reason for managerial work."

When these studies are compared, one fact remains evident: *in order to evaluate the effectiveness of any organization, evaluators must agree, at least in theory, about what constitutes effectiveness.* In other words, what is organizational effectiveness and how can an organization increase its effectiveness?

There is no doubt that some groups are more effective than others. The problem is how to measure the effectiveness of a group, and how the measurements of different groups or the same group, taken at different times, can be compared. An even more basic question must be answered before these questions may be addressed: which characteristics or criteria actually define organizational effectiveness (Albanese, 1981)?

Both organizational theorists and managers agree that an organization should be and must be effective. But beyond this simple statement, disagreement arises between researchers, between researchers and managers, and between practicing managers themselves about what effectiveness is and how to evaluate it. The definition and evaluation of effectiveness remain controversial and ill-defined at best. Even though ill-defined, it is against this concept that an organization's success is evaluated. Therefore, any attempts to improve a unit's effectiveness may be doomed to frustration and failure unless the manager has an understanding of the concept of organizational effectiveness and how it is to be defined. This concept must be based upon an understanding of who is making the assessment and the basis upon which that assessment is made.

Air Force Civil Engineering Management

Major General Clifton D. Wright, Jr., Director of Engineering and Services, USAF, states:

> Our course for the future must simply be to continue to grow, again not in quantity but in quality. Since base level activities are where we ultimately make or break our mark, it is at base level that we must ensure our people have the resources; employ the most efficient management techniques; and are trained and motivated to do their jobs. (Wright, 1982)

It is in this context that organizational effectiveness becomes so important for Air Force managers in general and for base level civil engineering organizations in particular. Because of limited resources and the continuing call to "do more with less," the more effective an organization is, the greater its ability will be to function in today's environment. Steers (1976) has referred to this pursuit of organizational effectiveness as the basic responsibility of management. Thus, a primary task of all managers must be to develop the strategies and management styles that promote organizational effectiveness (Davis & Dotson, 1981).

With regard to management, Air Force (AF) units are similar to civilian organizations. That is, they require leadership and management of their resources. Hence, regardless of the size of the particular organization, it is a basic responsibility of all AF managers to pursue organizational effectiveness within their units. Base level civil engineering (CE) organizations are no exception.

Base civil engineering organizations are maintenance, repair, and minor construction organizations located on most operational installations. Their primary mission is "to acquire, construct, maintain and operate real property facilities, and to provide related management, engineering, support, and service" (AFR 85-10, 1975, p. 2). They are generally the largest service organization on an AF base and, according to Burgess (1978), frequently spend 40 to 60 percent of the base's total operations and maintenance budget. As such, they are most prone to criticisms of ineffectiveness and inefficiency (Burgess, 1978). Their goal is

> to provide an operational installation capable of supporting the mission, including the development and implementation of programs designed to improve the livability of the base community. (AFR 85-1, 1982, p. 9)

In short, every civil engineering organization is a nonprofit organization whose primary mission is service. Civil engineering organizational functions include:

1. Management of Air Force real estate,
2. Planning and programming facility requirements,
3. Utility services,
4. Maintenance and repair of structures and equipment,
5. Engineering and construction,
6. Fabrication, minor construction, maintenance, and repair of training aids,
7. Planning, scheduling, and performing custodial services, snow removal, refuse collection and disposal, entomology, and other services,
8. Fire protection,
9. Family housing management.

Family housing units, office buildings, roads, heating, air conditioning, water treatment, and fire protection are all provided and maintained by civil engineering. As a result, everyone who lives, works, or visits on a base is exposed to some aspect of civil engineering's responsibility. "No other base organization directly affects the living environment of every person on a base as does the BCE organization" (AFR 85-1, 1982, p. 9). Those who live on, work on, or visit a base often evaluate the effectiveness of the civil engineering organization based upon this exposure and their own definition of effectiveness. This "environment" motivates many civil engineering managers (especially the base civil engineer [BCE]) to continually emphasize improved effectiveness within his/her organization.

Since civil engineering efforts are so visible to base personnel, civil engineering personnel are in the position of trying to get the job done to <u>everyone's</u> satisfaction (AFR 85-1, 1982). Many people and organizations continually evaluate civil engineering's performance on those aspects in which the users have direct involvement. With such a diverse group of evaluators, it is possible that a wide range of organizational effectiveness criteria or characteristics may be found to define civil engineering organizational effectiveness. Among base personnel, those most directly concerned with evaluating the effectiveness of the civil engineering organization and whose evaluations have the most influence on organizational objectives and behavior are the base civil engineer (BCE), the base commander, and the wing commander.

Statement of the Problem

In order to improve his/her unit's effectiveness, the BCE should have an understanding of organizational effectiveness. That is, he/she must have an operational definition of organizational effectiveness. Although many official visitors (e.g., higher headquarters, Inspector General [IG], MAJCOM Civil Engineering and Services Management Assistance Team [CESMAT], Air Force Civil Engineering and Services Management Evaluation Team [CESMET]) evaluate the BCE's organizational effectiveness, no one set of criteria is used to make this evaluation. As a result, the BCE is pulled between satisfying the different criteria of these evaluators and the criteria used by senior commanders on base. Base and wing commanders evaluate the effectiveness of the BCE, at least in part, upon the effectiveness of the civil engineering organization. Because the evaluations by the base and wing commanders directly affect the BCE's support, retention, and promotion opportunities, these commanders' perceptions of what defines organizational effectiveness are of prime importance to the BCE.

The Air Staff, in this year's (1982) research proposals to the Air Force Institute of Technology (AFIT), suggested that the BCE needs a tool or technique for determining his/her unit's effectiveness. This tool should combine the varied demands and perspectives of the diverse group of evaluators into a single set of criteria from which the BCE can make responsible decisions that will have a probabilistic result of improving his/her unit's effectiveness.

Objectives of the Research

The objective of this research was to develop an organizational effectiveness model for base level civil engineering units from the viewpoint of wing, base, and civil engineering squadron commanders. The approach to this study was to investigate past literature and modeling techniques previously used in organizational effectiveness. It was the authors' intent to develop a survey that would determine the criteria necessary for defining organizational effectiveness within civil engineering units and to use these criteria to develop a model to define organizational effectiveness. It is the authors' desire that the BCE will ultimately be able to use this model to identify areas within his/her organization that may be improved, thereby increasing organizational effectiveness.

Research Questions

To answer the research objectives, the following three research questions were established:

1. What criteria (characteristics or traits) define organizational effectiveness within base level civil engineering organizations?

2. How can these criteria be incorporated into an overall model to define organizational effectiveness within base level civil engineering organizations?

3. How do these criteria differ among ·

(a) commanders

(b) commands

(c) bases grouped by size?

Scope and Limitations of Study

As discussed in Chapters II and III, the scope of this study is limited to:

1. Civil engineering units within the continental United States (CONUS) in a peacetime environment;

2. The perceptions of wing commanders, base commanders, and base civil engineers;

3. The perceptions of only the host wing commander, although some installations support more than one wing and thereby have more than one wing commander;

4. Defining the criteria or areas of importance, not how to measure the criteria. Consequently, this research effort is only the first stage in the overall response to the Air Staff's request (1982). As the research literature will point out, the first stage in developing an effectiveness model is to identify the criteria which define effectiveness. This is the purpose of this research. (Follow-on research, in stage 2, will be required to develop

measurements for these criteria. The third stage of this combined effort will involve the validation and application of the model developed in stages 1 and 2.)

Assumptions

This research effort is based upon the following assumptions:

1. The effectiveness ratings of wing commanders and base commanders are of primary significance to base civil engineers.

2. The effectiveness ratings of wing and base commanders are based in part upon the service the BCE provides to its individual customers.

3. Overseas BCE organizations are more concerned about wartime readiness than are units located in the CONUS.

4. Commander's responses to the questionnaire will be dependent upon base size, the presence of a major air command or numbered air force headquarters on the base, the position of the commander in the civil engineering chain of command, and the specific host command responsible for the base or installation.

5. The criteria considered to be most important in defining organizational effectiveness for civil engineering squadrons will be dependent upon the respondent's perceived level of the unit's organizational effectiveness.

Definitions and Acronyms

1. AFLC--Air Force Logistics Command

2. AFSC--Air Force Systems Command

3. ATC--Air Training Command

4. Base Civil Engineer (BCE)--the military squadron commander of the base civil engineering group, squadron, or flight.

5. Base Commander--the military commander of the combat support or air base group, the commander responsible for the day-to-day operation of the base support functions and facilities.

6. CESMAT--major air command Civil Engineering and Services Management Assistance Team--a team of civil engineering and services personnel located at each major air command designed to periodically visit bases within that command and assist civil engineering and services personnel in solving management problems.

7. CESMET--Air Force Civil Engineering and Services Management Evaluation Team--a team of civil engineering and services personnel located at Headquarters USAF, Washington, D.C. Their purpose is similar to that of the major air command CESMAT teams; however, they visit all bases within the Air Force.

8. MAC--Military Airlift Command

9. OJT--on-the-job training

10. SAC--Strategic Air Command

11. TAC--Tactical Air Command

12. Wing Commander--the military commander responsible for all functions, such as flying, training, and maintenance on an AF installation.

CHAPTER II

LITERATURE REVIEW

Introduction

This chapter provides a review of the theory of organizational effectiveness. It describes organizational effectiveness and suggests ways it may be defined within an organization. Various models used by researchers to assess organizational effectiveness are also described. The authors suggest that the technique for determining a unit's organizational effectiveness will be dependent, in part, upon who is making the assessment and upon their definition of organizational effectiveness.

Nonprofit Organizations

As the following review of the literature will indicate, measuring organizational effectiveness is a complex task at best. When the organization under discussion is a nonprofit organization, the analysis is even more complex because nonprofit organizations lack some of the more easily measured indices of effectiveness. Since the Air Force, and thus Air Force civil engineering organizations, is a nonprofit organization, a brief review of the special characteristics of this category is a necessary introduction to the more general literature on measuring organizational effectiveness.

"A nonprofit organization is an organization whose goal is something other than earning a profit for its owners" (Anthony & Herzlinger, 1980, p. 31). Thus, for nonprofit organizations such as the Air Force, the difference between outputs and inputs is not an effective measure of how well the organization achieves its goals. The goal of a nonprofit organization is to render as much service as possible with the given resources, or to use as few resources as possible in rendering the necessary amount of service. Thus, in nonprofit organizations, decisions made by management are intended to result in providing the best possible service with the available resources. Success is measured primarily by how much service the organization provides and by how well those services are rendered (Anthony & Herzlinger, 1980).

Since service is a more vague, less measurable concept than profit, it is difficult to measure performance in a nonprofit organization. In addition, it is difficult to measure the relationship between costs and benefits in a nonprofit service organization. Nevertheless, despite these difficulties, even nonprofit organizations must be controlled. Management must assure that resources are used efficiently and effectively. The management control process is affected by certain characteristics of nonprofit organizations. These characteristics may be grouped under the following general headings (Anthony & Herzlinger, 1980):

1. The absence of a profit measure to provide a focus for decision making.

2. The tendency to be service organizations.

3. Constraints on goals and strategies. Nonprofit organizations have much less freedom of choice and tend to change strategies slowly if at all.

4. Less dependence on clients for financial support. There is no direct connection between services received and resources provided.

5. The dominance of professionals. Professionals are motivated by dual standards: (a) those of their organizations and (b) those of their professional colleagues. The former standards are related to organizational objectives; the latter may be inconsistent with organizational objectives.

6. Differences in governance. The course of action that best represents the public interest in nonprofit organizations is much more difficult to decide than the course of action that is most likely to increase profits in a profit-oriented company.

7. Differences in top management. In most business organizations there is no doubt that the chief executive officer has responsibility for everything, but in some

nonprofit organizations the chief executive officer does not have such overall responsibility.

8. Importance of political influences.

9. A tradition of inadequate management controls. Nonprofit organizations have been slow to adopt twentieth-century accounting and management control concepts and practices.

Of these characteristics, the absence of a profit measure is the most important. All organizations use resources to produce goods and/or services (i.e., they use inputs to produce outputs). An organization's effectiveness can be measured by the extent to which its outputs accomplish its goals (Anthony & Herzlinger, 1980). In most common usage, effectiveness refers to the degree of congruence between organizational goals and observable outcomes. In this sense, effectiveness is well defined only if both goals and outcomes are well defined and the comparison of the two is meaningful (Hannan & Freeman, 1977).

In a profit-oriented organization, the amount of profit provides an overall measure of both effectiveness and efficiency. However, in many nonprofit organizations, outputs cannot be measured in quantitative terms. Furthermore, many nonprofit organizations have multiple objectives, and it is difficult, if not infeasible, to combine the measures of the several outputs--each of which is intended to accomplish one of those objectives--into a single number that measures the overall effectiveness of the organization. The absence of a satisfactory, single, overall measure of performance comparable to the profit measure is the most serious management control problem in a nonprofit organization (Anthony & Herzlinger, 1980).

Definition of Organizational Effectiveness

> While most organizational analysts agree that the pursuit of effectiveness is a basic managerial responsibility, there is a notable lack of consensus on what the concept itself means. (Steers, 1976, p. 50)

The term "organizational effectiveness" has been used in a variety of contexts. A financial analyst would equate organizational effectiveness with high profits or return on investment; a line manager by the amount and quality of goods or services generated; and a research and development scientist by the number of new patents, new inventions, or new products developed by the organization. These definitions are too situation-specific and value-laden to be of much use. Many organizations are unique and pursue divergent goals (Steers, 1976).

One approach to this problem would be to define organizational effectiveness in general terms of an organization's ability to acquire and efficiently use available resources to achieve its goals. Inherent in this definition is the notion that effectiveness is best judged against an organization's ability to compete in a turbulent environment and successfully acquire and use its resources. Such a definition focuses on operative goals as opposed to official goals. It seems more appropriate to assess the level of effectiveness against the intended objectives of the organization rather than against a list of objectives meant principally for public approval. Thus, an organization is best judged against those goals it actually intends to pursue (Steers, 1976).

Another approach would be to think of organizational effectiveness as an abstract entity which has no single, direct operational definition but which describes an attitude or theory of what organizational effectiveness is. The function of the model would be to identify the kinds of variables to measure and to specify how these variables, or components of effectiveness, are or should be interrelated (Campbell, 1981). It was this approach the authors pursued in this research effort.

Criteria of Effectiveness

As the above definitions indicate, organizational effectiveness is not a physical characteristic measurable by the direct reflection of any single attribute. This does not mean that organization effectiveness cannot or should not be measured, but that some indirect measure must be developed to reflect organizational effectiveness.

The lack of good criteria or measures proves there are no simple formulas for overcoming the problems associated with assessing effectiveness. However, according to Cameron (1980), one useful strategy is to restrict the concept of organizational effectiveness to a specific referent of a limited aspect of the organization. This can be done by focusing on certain critical *a priori* choices that help give the concept of organizational effectiveness some meaning in each evaluation. That is, certain critical choices should guide the assessment of the organization--an assessment that will provide a basis for selecting among certain inevitable tradeoffs (Cameron, 1980). But the selection of criteria to assess an organization's effectiveness means relatively little until decisions for which these criteria are to be used are defined and the economic and political conditions in which the organization must operate are taken into account. There are at least three kinds of decisions for which organizational criterion data could be used (Campbell, 1981):

1. Discussions about whether some aspect of a system is in a good state or a bad state. Turnover rates could be an indicator of this aspect of the system; frequency of racial incidents could be another; and customer satisfaction yet another.

2. Diagnoses or decisions about why the system is in the state that it is. For example, what causes the high turnover rates, why are there so many racial incidents, and

why are customers dissatisfied with the services provided to them?

3. Planning decisions about what actions should be taken to change the state of the system. That is, what should be done to lower turnover rates, the frequency of racial incidents, or to improve customer satisfaction?

Frequently, there can be no perfect effectiveness evaluation; however, evaluations can be improved by addressing six critical questions: (1) what domain of activity should be the focus of the evaluation, (2) whose perspective, or which constituency's point of view should be considered, (3) what level of analysis should be used, (4) what time frame should be employed, (5) what type of data should be used, and (6) what referent should be employed (Cameron, 1980)? The following discussion will address each of these questions.

Question 1. What domain of activity should be the focus of the evaluation?

Most organizations operate in a variety of domains or areas of concern. A university, for example, may have the following domains of activity: (1) an academic domain emphasizing teaching, research, and professional development, (2) an external adaptation domain emphasizing community service and career-oriented training, (3) an extracurricular domain emphasizing the personal, social, and physical development of students, and (4) a morale domain emphasizing the satisfaction and morale of students.

A business, on the other hand, may operate in other domains of activity. For example, it may be concerned with (1) the customer satisfaction domain emphasizing service and concern for customer complaints, (2) an external adaptation domain emphasizing community involvement by its employees, (3) an employee relations domain emphasizing concern for employee health, morale, and satisfaction, and (4) a product quality domain emphasizing reliability and quality control in the production of their product or service.

The importance and relevance of particular domains of activity change as organizations progress through their life cycles. Cameron's (1980, 1981) research on organizational development has shown that individually oriented domains and activities focused on input acquisition are most important in early stages of organizational development and in times of high uncertainty and change. Domains focusing on organizational/environment relations and the production of organizational outputs are most important at latter stages in the life cycle when the organization has become institutionalized and bureaucratic.

Cameron (1980) found that different organizations emphasize and succeed in different domains, and over a period of time any single organization may change the domain(s) it emphasizes. In evaluating organizational effectiveness, the selection of the domain(s) of activity is very important.

Air Force civil engineering (CE) organizations are institutionalized and bureaucratic organizations accomplishing their missions by following regulations and directives established by higher headquarters. Thus CE's domain of activity emphasizes its organizational/environmental relations and the production of organizational output.

Question 2. Whose perspective, or which constituency's point of view should be considered?

Effectiveness evaluations always reflect the values of some major constituency. That is, the criteria used for the evaluation of organizational effectiveness are derived from one particular point of view or perspective. Increasing organizational effectiveness from one constituency's perspective may result in lowering effectiveness from another constituency's perspective. Organizations seldom, if ever, satisfy all strategic constituencies, and certain constituency viewpoints become more influential than others.

In the Air Force, wing commanders and base commanders, due to their position of rank over the BCE, may have tremendous impact on the evaluation of organizational effectiveness of CE units under their command. Whether they agree or disagree with each other's assessment, the perspective to be used must be addressed prior to any evaluation. Selecting indicators from one powerful constituency's perspective or selecting more general indicators addressing multiple constituencies' perspectives requires conscious tradeoffs when evaluating organizational effectiveness.

Question 3. What level of analysis should be used?

This question refers to the level of aggregation to be used in the evaluation. There are at least three broad levels that can be considered in evaluating organizations: that of individual members, that of groups or subunits, or that of the overall organization as a unit. In the Air Force, for example, the evaluation of a CE unit may be assessed at the squadron level (entire CE organization), the branch or shop level (engineering branch, operations branch, heating shop), or the individual worker level.

Research by Hannan and his associates (as reported by Cameron [1980]) points out that organizational failure frequently results from focusing on the wrong level for analysis. Therefore, the evaluator should carefully select the appropriate level of analysis, depending upon the domain and constituency, even though some levels are more difficult to assess than others.

Question 4. What time frame should be employed?

The time frame is important because long-term effectiveness may be incompatible with short-term effectiveness. Organizations may want to trade off short-term effectiveness to guarantee long-term effectiveness. The connections between short-term and long-term effectiveness are frequently ambiguous. Therefore, evaluators of organizational effectiveness should be sensitive to the tradeoffs inherent in the choice of time frame. Because of the AF assignment structure, BCEs, base commanders, and wing commanders frequently move to new assignments. The result is a variety of managers with potentially different organizational effectiveness concepts in a relatively short time frame. This type of diverse organizational structure may result in commanders emphasizing short-term effectiveness more than long-term effectiveness when evaluating civil engineering units.

Question 5. What type of data should be used?

Another choice faced by evaluators of organizational effectiveness is whether to use information collected by the organization and stored in official documents, or whether to rely on perceptions of members or organizational constituencies. This is a choice between using objective data or subjective, perceptual data to assess effectiveness. Objective data have the advantages of being quantifiable and less potentially biased than individual perceptions. On the other hand, objective data are frequently kept only on official criteria of effectiveness. This may make them narrow in scope. The advantage of subjective or perceptual data is that a broader set of criteria may be assessed from a wider variety of perceptions. The disadvantages, however, are that respondents' biases, dishonesty, or lack of information may degrade the reliability and validity of the data. The selection of the type of data to be used is important because an organization may be judged to be effective on the basis of subjective perceptions even though objective data indicate that the organization is ineffective--or vice versa.

Question 6. What referent should be employed?

Once effectiveness indicators have been selected, there are a variety of possible referents against which to judge those indicators. Five alternatives are comparative evaluation, normative evaluation, goal-centered evaluation, improvement evaluation, and trait evaluation. Comparative evaluation compares one organization's performance against another organization's performance. Normative evaluation compares the organization's performance against a standard or an ideal performance. Goal-centered evaluation compares organizational performance against the stated goal of the organization. Improvement evaluation compares the organization's performance against its own past performance on the same indicators. Trait evaluation evaluates an organization on the basis of the static characteristics independent of its performance on certain indicators.

Goal-centered, comparative, and normative referents may be difficult to evaluate in what Cameron (1980) calls organized anarchies, that is, loosely coupled organizations that operate in multiple domains. In organized anarchies, goals are multiple, contradictory, changing, and ambiguous; ideal standards are difficult to find; and there may not be any meaningful indicators common to the organizations to be compared. Trait evaluation requires that the actual characteristics of effective organizations be described, with the emphasis on organizational traits rather than on organizational behaviors. The advantage of this approach is that less biased perceptions are present than in other evaluations; however, this approach may lead to a variety of criteria and a very complex analysis. In summary, it is important that evaluators select the appropriate referent against which to compare effectiveness criteria (Cameron, 1980).

Once these questions have been addressed to guide the assessment of an organization, a decision must be made as to what criteria are necessary to operationally define the effectiveness of that organization. Unfortunately, there is no universally accepted set of criteria for assessing organizational effectiveness (Steers, 1976). However, it is generally agreed that organizational effectiveness is a combination of several, individually assessible factors and must be evaluated using these multiple criteria (Cameron, 1981; Connolly, Conlon, & Deutsch, 1980; Cunningham, 1977; Steers, 1976).

The information provided in Table 2.1 illustrates this point. Table 2.1 identifies criterion measures used by four researchers in assessing organizational effectiveness. Cameron (1981) used the fifty-eight criterion measures identified in an analysis of colleges and universities; Campbell (1981) identified thirty in his review of past literature; Burgess (1978) used twenty-four in his analysis of BCE organizations; and Hendrix (1979) used three in the development of the Organizational Assessment Package (OAP) now used by the Air Force Leadership and Management Development Center (LMDC).

Modeling Theory and Applications

Combining the measurement of several separate criteria to obtain an overall condition from a wide range of reporting units suggests that the use of modeling theory may be appropriate (Bross, 1957). However, the widespread application and misapplication of modeling during the past eight to ten years has caused many managers to be leery of using this technique or accepting its results (Albanese, 1981). It is a topic worthy of review in this investigation.

TABLE 2.1

CRITERION MEASURES FOR ORGANIZATIONAL EFFECTIVENESS

Cameron	Campbell	Burgess	Hendrix
Manifested student dissatisfaction	Overall Effectiveness	Base appearance	Criterion selected
Received student complaints	Productivity	Meeting commitments	Managerial style employed
Attrition from dissatisfaction	Efficiency	Design and construction schedule compliance	Situational environment
School spirit displayed	Profit	Energy conservation	
Extra work and study by students	Quality	Family housing management	
Student academic attainment	Accidents	IWP compliance	
Emphasis on outside academic activities	Growth	Obtaining major command funding for M&MC contracts	
# of students employed in major field	Absenteeism	Responsiveness to "command interest" work requirements	
Career goals are met	Turnover	Satisfaction of base personnel with CE performance	
# of career oriented courses	Satisfaction	Satisfactory IG reports	
# of students obtaining jobs of first choice	Motivation	Service call response	
Importance of career education-job attain	Morale	Weekly schedule compliance	
Opportunities for personal development	Control	Work force productivity	
# going on to graduate	Conflict/Cohesion	Financial Management	
Student academic development	Flexibility/Adaptation	CE MBO program	
Nonacademic growth	Planning & Goal Setting	Reliability of essential base utilities	
	Goal Concensus	Knowledge, ability, & initiative of lower level managers	
	Role & Norm Congruence		
	Managerial Interpersonal Skills		
	Managerial Task Skills		
	Information Management & Communication		
	Internalization of Organizational Goals		
	Readiness		
	Utilization of Environment		

TABLE 2.1--Continued

Cameron	Campbell	Burgess
Emphasis on nonacademic activities	Participation & shared influence	Squadron discipline
Importance of personal development	Evaluations by external entities	Sensitivity to command
Faculty preference of institution over others	Stability	Responsiveness to operational mission needs
Admin preference of institution over others	Value of human resources	Communication and understanding with supported base units
Faculty satisfaction with employment	Training and Development Emphasis	Public relations program with weekly newspaper
Admin satisfaction with employment	Achievement Emphasis	Leadership
Faculty satisfaction with school		Motivating personnel
Admin satisfaction with school		
Faculty attendance at professional conferences		
Faculty publications		
Teaching at "cutting edge"		
Awards received by faculty		
Professional development		
Community service of employees		
Professional activities outside of college		
Emphasis on community relations		
Community programs sponsored		
Adaptiveness to external environment		
National reputations of faculty		
Drawing power for local students		
Drawing power for national students		

TABLE 2.1--Continued

Cameron
Drawing power for faculty
Drawing power for financial resources
Ability to acquire resources
Student/faculty relations
Intergroup relations
Amount of feedback obtained
Typical communication type
Presence of cooperative environment
Flexibility of administration
Levels of trust
Amount of conflict and frustration
Problem solving styles used
Use of talents and expertise
Types of supervision and control
Types & adequacy of recognition & rewards
Decision-making styles
Amount of power associated with participation
Equity of treatment and rewards
Organizational health
Long-term planning and goal setting
Intellectual orientation

Texts on modeling (Anderson, Sweeney, & Williams, 1982; Bross, 1957) frequently begin by describing models as either iconic, analog, or mathematical (symbolic). Iconic and analog models are physical representations of their real-world counterparts. On the other hand, mathematical models represent the relationships between factors by using symbols and mathematical operands. All three types of models try to represent the real-world environment.

A mathematical model can frequently be used to represent or duplicate conditions in the real-world situation. For example, economic order quantity models have been used for several years to assist managers in determining production schedules, storage requirements, order quantities, and ordering frequencies. While in one sense these models are the most abstract and distant from the real world, they can be made as complicated as necessary to achieve realism. They parallel the real world to the extent that the model builder is willing or able to add the necessary constraints to make them do so. Mathematical models have some distinct advantages and disadvantages to other procedures for measuring organizational effectiveness.

The requirement to construct a model causes the model builder to logically think through the process he is attempting to model. This may force him/her to consider relevant characteristics that may have been otherwise overlooked. However, there are two distinct disadvantages of models which must be considered. First is the conception phenomenon. This is the feeling of the builder that the model must be useful and workable because he created it. At least in the initial stages, this is a good attitude for the researcher to have, for it frequently provides the only drive available to continue with the task. Yet, if carried too far, such an attitude can halt further advancement (Bross, 1957).

Even more potentially disastrous are the effects of the abstraction phenomena. Since models are inherently simplifications of the real world, model builders must exercise extreme care not to oversimplify their models. They must strike a delicate balance between creating a model that is neither so simple nor so complicated that it is useless to the practical manager (Bross, 1957).

Several different approaches have been suggested for modeling organizational effectiveness. The decision of which approach to use should be based on which approach satisfies the user's requirements and has been accepted as valid in previous efforts (Campbell, 1981). Five approaches have received particular attention. These approaches are (1) goal models, (2) resource models, (3) process models, (4) satisfaction models, and (5) contingency models (Cameron, 1981).

Goal Models

The first approach is the goal model. It suggests that effectiveness is measured by the extent to which an organization achieves its goals. At least four problems are apparent with this approach. The first problem involves stated versus operational goals. An organization whose stated goal is to provide the best possible customer service must operationally define this goal and may find itself striving to achieve such operational goals as ten customers served per hour or no more than three complaints per week rather than the stated goal of providing the best possible customer service. A second problem is that an organization may be effective in an area where it has no stated goals. Such a situation occurred with the National Aeronautics and Space Administration (NASA) in the 1960s. Although NASA's early efforts in space exploration were not totally successful, NASA was effective in developing the miniature circuitry industry. Third, organizations with low goals may easily achieve them, yet these organizations could hardly be considered as effective as other organizations whose goals were more difficult and which, as a result, did not completely achieve them. The fourth problem, readily apparent with the goal-centered process, is that some organizations may have conflicting goals, and will be unable to completely achieve all (or any) of them. Such a condition could occur with a manufacturing organization that has goals of increased productivity, increased job satisfaction, and limited funds for capital expansion. Increased productivity, in the short run, might be achieved at the expense of job satisfaction by asking employees to work harder, faster, or longer for no additional pay. This request would most certainly be counter to the goal of increased job satisfaction.

Resource Models

The second approach is the system resource model (Cameron, 1981). This model measures effectiveness as a function of the organization's ability to obtain the resources required for its continued functioning. However, in nonprofit organizations, obtaining inputs may not be closely tied to producing outputs. For example, an increase in military appropriations may go for personnel costs, with no real or immediate increase in the amount of defense provided.

Process Models

The third approach is the process model (Cameron, 1981). In this model, effectiveness is measured as a function of the internal harmony, efficiency, and smooth operation of the organization. However, if this is the only approach considered, an analyst could infer that an organization such as the New York Yankees in 1977 and 1978 was not effective because it suffered from an almost continuous series of internal arguments between players and management. Yet, in both years they won the World Series.

Satisfaction Models

The fourth approach described by Cameron (1981) is a satisfaction model, wherein effectiveness is measured by the degree of satisfaction provided each of the organization's separate constituencies. Such a model equates effectiveness to the degree that the organization meets the needs of employees, management, shareholders, customers, and the general public. This approach requires the organization to define all of its constituencies and determine their needs. In addition, an organization with no effective competition may be successful or effective without considering the needs of all its constituencies. An organization that is the only major employer in a community, for example, may not be as concerned with its employees' concerns since the employees have no other place to work.

Cunningham (1977) has suggested seven approaches to effectiveness modeling based on the type of organization being considered and the perspective of the evaluation. When evaluating the effectiveness of the organizational structure, he suggests using a goal or systems approach. When evaluating the effectiveness of the organization's human resources, he suggests using a productivity or job satisfaction approach. Yet when evaluating the effectiveness of organizational functions or activities, he suggests a resource utilization approach, or a functional criteria approach.

Each of the models discussed to this point can be described as univariate models. That is, they measure the effect of a single independent variable on organizational effectiveness. It appears there are as many different approaches to modeling organizational effectiveness and organizations to which these models can be applied as there are writers on the subject. This results because each new variable considered under the univariate modeling concept requires a new model.

Contingency Models

Steers (1976) and Albanese (1981) suggest that the univariate or fractional approach has limited value and will continue to limit further progress in measuring and modeling organizational effectiveness. They suggest that the proper approach, at this point, would combine several measures of organizational effectiveness into a single model. Such an approach is referred to as a multivariate or contingency model. This approach should be based on the level in the organization for which the effectiveness is being determined and should combine all significant factors available at that level.

Mahoney (1969) and Cameron (1981) have suggested that the contingency model is the only way to move research and modeling of organizational effectiveness off of the univariate plateau. This new approach will allow continued progress in the research of organizational effectiveness. General acceptance of this theory has resulted in contingency modeling currently receiving the most emphasis from organizational researchers.

Unlike the univariate models discussed earlier, contingency models are based on a systems approach to organizations. The systems approach suggests that an organization should be looked at or considered as a complete entity. An analogy to the systems approach within organizations is the general practitioner's approach to diagnosing an illness. The initial diagnosis of the doctor is based on the overall condition of the patient's body (system). No final diagnosis can be made until this analysis has been made.

The Systems Perspective. In light of the research by Steers (1976), Mahoney (1969), and Cameron (1981) suggesting that any real progress in modeling organizational effectiveness must be based upon contingency or systems theory, researchers must understand systems theory and show that it applies to the system being studied. The systems approach requires management and researchers to consider the effect of all known factors on the organization. Any predictions of cause or effect should be based on the effect to the entire system. Understanding and acceptance of the systems approach is paramount to the acceptance of contingency modeling and theory. Specifically, it is defined as how well the organization as a whole integrates its component parts to cope with its environment (Davis & Dotson, 1981). "Thus effectiveness is the degree of internal consistency and of organizational congruence of an organization with all elements of its environment" (Schoderbek, Schoderbek, & Kefalas, 1980, p. 23).

This approach is diametrically opposed to the traditional reduction method of solving problems. In the reduction method, the student was advised to divide a large problem into several smaller problems (Cleland & King, 1975). Instructors typically teach students that if a problem is too large to solve at once, they should break the problem down into a series of smaller problems that were solvable. Solving each of the smaller problems will, in effect, solve the larger problem.

Rather than narrowing the scope of the problem, the systems approach increases its scope, thereby increasing the number of known and unknown variables involved in any analysis and solution. Adoption of the systems approach, however, allows the researcher or manager to view the problem in its entirety. Solutions resulting from application of the systems approach must consider the effects of the solution on each constituency, subunit, or clientele of the organization.

In summary, contingency theory has its basis in systems theory and considers all things that occur within an organization to affect it in some way. Each of these events then becomes a possible factor in determining organizational effectiveness. The problem then becomes one of deciding which factors have the more or most significant effect.

When applied to human experience, contingency theory is intuitively appealing. In general terms, how effective humans are as individuals can be defined as how well they are able to function in their environments. A measure of their effectiveness is how well they are able to cope with the external factors or events they encounter. This theory is also intuitively appealing when applied to familiar organizations. A family's ability to exist is not just a function of its income, education level, or religious involvement, but can be seen as some combination of all of these variables, as well as many others.

A similar perspective can be applied to churches, businesses, and political parties. The ability of each of these organizations to be effective (cope with or manipulate their environments) is dependent upon some combination of many variables. These variables may not be separate, unique, or known (unless they are to be measured).

Steers (1975) suggests that contingency models are more applicable than other models to organizational theory because they are more able to measure the individual effects as well as interactive effects of several independent variables on the dependent variable, organizational effectiveness. This means that contingency models can measure the effect of limited available capital on organizational effectiveness, the effect of job satisfaction on organizational effectiveness, and the effect that limited capital and job satisfaction together have on organizational effectiveness. If the variables of limited capital and job satisfaction are independent, their combined effect will be the summation of their individual effects; however, if one variable affects the other (i.e., interdependent), their combined effect may vary significantly from their individual effects. This seems logical when applied to the variables just discussed. The lack of available capital may impact on job satisfaction which could, in turn, affect organizational effectiveness.

A contingency model would represent organizational effectiveness as a function of multiple independent variables. The symbolic representation of such a model might be

$$OE = f(a, b, c, \ldots, z)$$

where OE represents organizational effectiveness; and a, b, c, ..., z represent the various factors or independent variables used to predict or explain organizational effectiveness.

More specifically, this model would be of the form

$$OE = A + B_1a + B_2b + B_3c + \ldots + B_nz$$

where OE represents the dependent variable (organizational effectiveness); A equals a constant; a, b, c, ..., z represent the various factors or independent variables used to predict or explain organizational effectiveness; and B_1, B_2, B_3, ..., B_n represent the multiplication factors applied to each factor or independent variable.

This type of model was applied by Cameron (1981) in an analysis of universities from the perspective of the faculty and administration. Mahoney (1967) used this type of model in an analysis of eighty-four organizations ranging from administration to research. Two hundred forty-three subunits were evaluated using one hundred fourteen separate criteria. Regression analysis reduced this list to twenty-four criteria that were significant in explaining organizational effectiveness.

One of the more widely applied contingency models in the Air Force is the Three-Component Model of Organizational Effectiveness first proposed by Hendrix in 1976. This model is a multivariate model using three independent variables to measure organizational effectiveness. It defined organizational effectiveness as a function of (1) the criteria selected, (2) the managerial style employed, and (3) the situational environment (i.e., highly structured environment) of the organization. This model was updated several times before its validation in 1978 by the Air Force Human Resources Laboratory (AFHRL) at Brooks AFB, Texas. The model uses an organizational assessment package (OAP) to measure the level of each factor within an organization.

The OAP is now in the form of a standard questionnaire and has been used by the Air Force Leadership and Management Development Center to determine organizational effectiveness in several hundred organizations. Results of these tests indicate that the OAP and Hendrix's Three-Component Model of Organizational Effectiveness are quite reliable in predicting organizational effectiveness (Hester, 1980).

This is not to imply that other models cannot or should not be developed. Such models should, of course, be designed using other factors or additional factors as independent variables. These models may provide an entirely different set of criteria affecting organizational effectiveness and may be better for measuring or explaining organizational effectiveness in particular units or types of units. That is, Hendrix's model is a general model applicable to almost any organization, but it may not include some variables which are significant to the organizational effectiveness of a specific unit or type of unit.

CHAPTER III

METHODOLOGY

Introduction

This chapter describes the approach and techniques used to answer the research questions stated in Chapter I:

1. *What criteria (characteristics or traits) define organizational effectiveness within base level civil engineering organizations?*

2. *How can these criteria be incorporated into an overall model to define organizational effectiveness within base level civil engineering organizations?*

3. *How do these criteria differ among*

   (a) commanders

   (b) commands

   (c) bases grouped by size?

The first section of this chapter describes the bounds of the research, which were set by addressing the six questions proposed by Cameron (1980) and discussed in Chapter II. Within these bounds are described the population, the survey instrument used to collect data, and the survey results used as the report's data base. Later sections of the chapter describe the data manipulation and the analyses used to answer each research question.

Research Bounds

According to Cameron (1980), before any evaluation of an organization can be made, six critical questions must be addressed: (1) what domains of activity will be the focus of the evaluation, (2) whose perspective or point of view will be used, (3) what level of analysis will be used, (4) what time frame will be employed, (5) what type of data will be used, and (6) what referent will be employed? Relating these questions to the evaluation of civil engineering organizations established the bounds for the research.

Domain of Activity

As was discussed in Chapter II, Air Force civil engineering organizations by their very nature are nonprofit organizations. They are primarily concerned with providing a service to their customers (base personnel). Therefore, decisions made by management (commanders) are not intended to result in a financial profit but are intended to provide the best possible service with available resources. Because the Air Force is a nonprofit organization, civil engineering's management control process is affected by at least two specific characteristics peculiar to nonprofit organizations (Anthony & Herzlinger, 1980). These characteristics are:

1. Differences in responsibilities of top management

2. Constraints on goals and activities.

Unlike in profit-oriented organizations, where all subunits are responsible to the chief executive officer, the management of an Air Force installation results in the civil engineering organization being responsible to and evaluated by several different commanders (managers) or constituencies. Volumes of guidelines and regulations have been established to limit civil engineering activities to those of a highly structured environment. As a result, civil engineering's domain of activity is established and bureaucratic, focusing on the production of organizational output rather than input acquisition.

Perspective or Point of View

The second question refers to whose perspective or point of view will be used to guide the research effort. Even though civil engineering operates in a bureaucratic environment (tightly coupled chain-of-command structure with formalized rules and procedures), civil engineering is service oriented with multiple constituencies, and each of the individual constituencies may have a different point of view. Ideally, a service organization should be evaluated from the customer's or service recipient's perspective. Although customer opinions do have an effect upon the base level civil engineering organization's work effort, realistically the bureaucratic structure of the Air Force allows wing commanders, base commanders, and base civil engineers to have a more immediate effect upon the organization than the customers. However, if customers are dissatisfied with the service of the civil engineering organization, these commanders have mechanisms for identifying this dissatisfaction. Therefore, the attitudes and opinions of these commanders at least indirectly represent the attitudes and opinions of all civil engineering customers.

Level of Analysis

By definition, effectiveness can be measured at three levels within a structured organization such as civil engineering. The lowest level is individual effectiveness; the second level is the shop or branch level; and the third level is the overall organizational level. Because this study was based upon the perceptions of wing, base, and civil engineering squadron commanders, the authors chose the organizational level as the level of analysis. This level of analysis was used based upon the assumption that these commanders perceived civil engineering as an organization; not as a group of separate individuals or shops.

Time Frame Employed

The time frame of reference is important because long-term effectiveness may be incompatible with short-term effectiveness. Organizations may forego short-term effectiveness in order to guarantee long-term effectiveness. Therefore, a critical question that must be addressed is what time frame will be used for the evaluation?

At least two time frames are possible: (1) short- and (2) long-term. As pointed out by Dr. Stimpson (1983), both large corporations and the Air Force rotate senior managers (commanders) every two to four years. As a result, these commanders may become more concerned with the productivity and effectiveness of their organizations during the period for which they are directly responsible (the short term) rather than for the life of the organization (the long term). That is to say, the military policy of frequent assignment rotation may result in commanders being primarily concerned with the short-term rather than the long-term perspective of organizational effectiveness. This investigation, therefore, defined organizational effectiveness from the short-term perspective; however, some of the suggested criteria, identified as important by respondents, relate equally to both long- and short-term effectiveness.

Type of Data Used

The type of data used to define organizational effectiveness may be subjective, objective, or some combination of both. Because organizational effectiveness is a construct with no universally accepted definition, no predetermined set of criteria is available to define it (Steers, 1975). Therefore, any definition of organizational effectiveness must be based upon a set of subjective criteria selected or established by that constituency whose perspective is being used. Thus, the data collected in this research represent the subjective perceptions of the population surveyed.

Referent Employed

The last question to be addressed is what referent will be employed. That is, how will the model be used once it is created and validated. One of the objectives in this research was to create a model the BCE could use to increase organizational effectiveness within his/her organization. Therefore, an improvement evaluation referent (see Chapter II) which compares the organization's current performance with its past performance should be used.

Because civil engineering organizations have many areas of concern and are affected by many different constituencies, no single criteria model could accurately define organizational effectiveness within their organizations. Therefore, a systems approach (as described in Chapter II) was used to model a definition of civil engineering organizational effectiveness.

Population of Concern

The choice of the population of concern was determined by the perspective or point of view selected by the authors. Because the choice of perspective was that of commanders within civil engineering's chain of command, the population of concern for this research was the base civil engineer, his/her commander (the base commander), and his/her commander (the wing commander). The population was limited to these three positions at eighty-four operational Air Force bases located in the CONUS. Because of the chain of command in use at some bases, the position of wing commander may not exist. Instead, this function is operationally controlled from another installation. Where more than one wing was assigned to a base or installation, only the perceptions of the host wing commander were solicited. These constraints limited the potential sample size to 245 commanders (77 wing commanders, 84 base commanders, and 84 base civil engineers). Due to the limited population, a census rather than a random sample was attempted. (See Appendix A for a list of the positions and bases used in the census.)

Installations were limited to the CONUS because of the greater emphasis placed upon wartime commitments at overseas installations. This limitation does not mean that CONUS locations are not concerned with wartime commitments or that emphasis upon wartime commitments are not valid criteria. However, the authors initially intended to develop a CONUS-restricted model which could be expanded to overseas installations through future research efforts.

Demographic data collected from the population measured were (1) base size, (2) command position, (3) major air command, and (4) whether the installation was the headquarters of a major air command or numbered air force.

Survey Instrument

A survey questionnaire (Appendix B) was used to collect data to answer the research questions. The proposed questionnaire was pretested for clarity and face validity among the Graduate Engineering Management (GEM 83S) class members of AFIT and selected members of the faculty of the School of Civil Engineering, AFIT, Wright-Patterson AFB, Ohio. Several revisions suggested from the pretest responses were incorporated in the questionnaire before it was forwarded to the Personnel Survey Branch, AFMPC, for approval.

The approved questionnaire was assigned USAF survey control number 83-23 with an expiration date of July 1, 1983.

The survey packages were mailed to all commanders shown in Appendix A on May 5, 1983.

In order to address the assumption that base size might affect the survey responses of the commanders, the eighty-four bases in Appendix A were grouped by base size. The groups were formed on the basis of the combined civilian and military personnel strength as reported in the May 1981 issue of the Air Force Magazine. Bases with personnel strengths of less than 4000 were defined as small bases (coded A on the survey); bases with personnel strengths of 4000 to 7500 were defined as medium bases (coded B on the survey); and bases with personnel strengths greater than 7500 were defined as large bases (coded C on the survey). Surveys were coded by base size, as shown in Appendix C, prior to mailing. Although the questionnaires were marked by base size, neither this indication nor the questions in the questionnaire itself could identify individual respondents or their base location. This was done to assure respondent anonymity.

The survey questionnaire consisted of four parts. Part 1 requested the following demographic data: title of respondent, command, and whether or not the headquarters of a major air command or a numbered air force was located on the installation. This information was used for statistical analysis of the responses to parts 2 and 3 of the questionnaire.

Part 2 of the questionnaire contained thirty-seven separate criteria which have been used by command CESMATs and the IG to define organizational effectiveness within civil engineering organizations (Knutson, 1982). Respondents were asked to rate, on a five-point Likert scale (1 = of no importance, 2 = of slight importance, 3 = moderately important, 4 = very important, and 5 = essential), the importance he/she would assign to each of these criteria in defining organizational effectiveness. In the case where a commander wanted to nominate criteria not listed in the original thirty-seven criteria, blank spaces were provided; respondents were asked to nominate their criteria and rate the importance of their nominated criteria.

Part 3 of the survey required respondents to rank the five criteria they perceived to be most important in defining organizational effectiveness within civil engineering units. Respondents were also asked to subjectively rate the effectiveness of their own civil engineering units on a segmented scale from 0 to 100 percent.

Part 4 allowed for open-ended responses and any additional comments the respondents might wish to add concerning organizational effectiveness of civil engineering units. Although of little statistical significance in this particular research, the authors felt part 4 would identify any unrecognized strengths or limitations in this research.

This information may be particularly valuable for follow-on research efforts.

A copy of the cover letter, AFIT Dean of the School of Systems and Logistics indorsement, Privacy Act statement, and questionnaire are included in Appendix B.

Analysis

Survey responses were coded and loaded into AFIT's Cyber computer system. Appendix D contains a complete listing of this data file. A descriptive presentation of the survey data is contained in Chapter IV. Suggested additional criteria from part 2 of the survey were not received in sufficient numbers to allow any statistical analysis. These additional criteria and comments were edited for spelling and grammar errors only and are included in Appendix I.

The presentation of survey data in Chapter IV shows the survey return rate by position of command, base size, and major air command. Chapter IV also displays the mean level of importance assigned to each of the thirty-seven criteria by the various commanders. Mean levels of importance for each criterion are shown for

1. All respondents combined,
2. Respondents based upon position of command,
3. Respondents based upon base size, and
4. Respondents based upon major air command.

For presentations 2 through 4 just mentioned, analysis of variance techniques (ANOVA) were used to identify any statistically significant differences between the mean levels of importance for each group of respondents. This analysis was performed using the ONEWAY ANOVA subroutine from the Statistical Package for the Social Sciences (SPSS). Where a significant ANOVA was obtained, the Duncan's multiple range test was used to test all possible pairs of group means using a significance level of 0.05 (confidence level of 95 percent) (Nie, Norman, Hull, Jenkins, Steinbrenner, & Bent, 1975). Appendix E contains a more complete discussion of ANOVA.

In part 3 of the questionnaire, respondents were asked to rank order the five criteria they believed to be most important in defining organizational effectiveness within a base level civil engineering organization. Points were assigned to each of the criteria based upon the number of first, second, third, fourth, and fifth place votes each criteria received. Five points were awarded for each first place vote, four points for each second place vote, three points for each third place vote, two points for each fourth place vote, and one point for each fifth place vote.

A FORTRAN program was written to compute total point values for each of the criteria. The five criteria receiving the highest total points were considered the criteria which respondents perceived to be most important in defining organizational effectiveness within base level civil engineering organizations. Point values for each of the thirty-seven criteria are presented in Chapter IV.

Chapter IV also shows a comparison of the perceived effectiveness, by the various commanders, of their respective civil engineering organizations. ANOVA tests were run to compare the mean effectiveness ratings of respondents based upon position of command, base size, and major air command. The results of this analysis are shown in Chapter IV.

Responses to each of the criteria in part 2 of the survey were considered to be interval data. (See Appendix F for validation and support for considering Likert data to be intervally scaled.) Because of the large sample size, the Central Limit Theorem was assumed to apply, and the data were assumed to be normally distributed. Therefore, parametric statistical techniques were used to analyze the data and answer the research questions. The SPSS computer program was used to support the analyses.

The following discussion describes the procedures used to answer each of the research questions.

Research Question 1. *What criteria (characteristics or traits) define organizational effectiveness?*

The survey questionnaire actually contained two separate and distinct sources of criteria to define organizational effectiveness. The first source was the thirty-seven original criteria from part 2 of the questionnaire. The second source was the open-ended question from part 2 which asked respondents to nominate additional criteria they believed to be important in defining organizational effectiveness within base level civil engineering organizations.

Since the survey questionnaire did not ask for a dichotomous response to the importance of each of the suggested criteria, the importance levels of the survey respondents could not be used to directly determine which criteria should or should not be included in a definition of organizational effectiveness. Therefore, a two-stage selection technique, based upon the judgement of the researchers, was used to select the criteria to be included in the definition.

The first stage consisted of two steps. In the first step, the researchers computed the mean level of importance for each of the criteria. Then the overall mean level of importance and standard deviation of responses to all of the suggested thirty-seven criteria were computed. In the second step, the researchers selected all criteria whose mean level of importance was greater than the overall mean level of importance minus one standard deviation. Since the overall mean minus one standard deviation was greater than 3.0, the criteria selected were considered to be at least moderately important (by the scale of importance on the questionnaire) in defining organizational effectiveness within base level civil engineering organizations.

In the second stage, the researchers considered criteria from the second source: those nominated by survey respondents in response to the open-ended question in part 2 of the survey. Appendix I contains a complete list of these additional criteria nominated by survey respondents, and the number of times each additional criteria was nominated. Since not all of the respondents had the opportunity to comment on the importance of these criteria, a separate method had to be used to select the important criteria from this source. The researchers chose to select any additional criteria suggested by eight or more respondents from the potential sample as important in defining organizational effectiveness. This number was selected because there was a clear break in the frequency of additional responses at this point.

Using these two procedures, the authors were able to select those criteria respondents perceived to be important in defining organizational effectiveness within base level civil engineering organizations.

Research Question 2. *How can these criteria be incorporated into an overall model to define organizational* *effectiveness within base level civil engineering organizations?*

The authors first attempted to use factor and regression analysis to develop a mathematical model of organizational effectiveness within base level CE organizations. However, limitations due to the dispersion of responses to the questionnaire (discussed later) did not allow this type of analysis. Even with all thirty-seven criteria included in the regression analysis, the resulting model was only able to explain 10 percent of the total variation in the dependent variable (organizational effectiveness).

It is most likely that the criteria determined to be important in defining organizational effectiveness from Research Question 1 are neither unique or unrelated. High multicollinearity (interrelationships between some of the criteria) is possible and should be expected. If multicollinearity exists, it must be considered and eliminated, if possible, prior to any further analysis.

Factor analysis is a statistical technique that eliminates multicollinearity by combining criteria which are highly correlated. For example, if two or more criteria vary by the same, or nearly the same, degree (in either the same or opposite directions), factor analysis will combine them into a single factor (Nie et al., 1975).

The reader is referred to Appendix G for a detailed discussion of factor analysis.

In addition to eliminating multicollinearity, the combining of correlated criteria allows factor analysis to create a model of the dependent variable (in this case, organizational effectiveness) as a function of a smaller set of new variables or factors composed from combinations of the original criteria. Factor analysis of the input data file was performed using the FACTOR subroutine of the SPSS program. The number of factors selected was based upon the specific technique described in Appendix G.

Using regression analysis, the authors first examined the factor analysis model to determine if a linear relationship existed between the factors of the model and the dependent variable, perceived organizational effectiveness. (Appendix H contains a discussion of regression analysis.) Because a linear relationship did not exist between the factors and perceived organizational effectiveness, the factor analysis model and the additional nominated criteria, identified in Research Question 1, were used to define a functional model of organizational effectiveness within base level civil engineering organizations.

One of the requirements of a functional model created from factor analysis is that each of the factors composing the smaller set of variables must be intuitively interpretable. That is, all of the original criteria combined in a factor (new variable) must have a logical relationship to each other as well as a mathematical correlation with the other criteria included in that factor. Although the eight factors in the model created from factor analysis were statistically independent, they were not intuitively interpretable. That is, the criteria included in each factor did not have a logical relationship with one another. The reader is referred to Appendix G for a discussion of the functional model created from factor analysis.

Because this functional model was not intuitively interpretable, the authors used a judgemental technique known as content analysis (Kohlhaas & Williams, 1980) to create a functional model to define organizational effectiveness within base level civil engineering organizations. Content analysis was first used extensively during World War II (Demidovich, 1983). It is a less mathematically rigorous technique than factor or regression analysis and is based more upon the judgement and experience of the researchers.

In content analysis, which uses the mental process of classification, each researcher independently reviews the list of independent variables (criteria) and develops a smaller list of factors or variables which he/she believes incorporates all of the original criteria. The researchers then compare their factor listings and develop a single list of factors or variables, smaller than the list of original criteria, that will incorporate all of the criteria from the original set of data. The original criteria are then reviewed and placed under the appropriate factors. Care must be taken to ensure that the criteria included in each factor are related and intuitively interpretable.

The set of factors resulting from content analysis may be used as the independent variables in a functional model of the original dependent variable. The criteria composing each factor may be used as the basis for measuring the level of attainment of that particular factor and serve as a starting point for refinement or validation of the proposed functional model.

The model created through content analysis expresses organizational effectiveness not as a linear combination of the criteria identified in Research Question 1 but as a function of a group or set of factors composed from the original criteria.

> A question arises about the reliability of the categorization of factors using content analysis. In very general terms it can be said that, in different contexts, the inter-rater [researcher] reliability of this technique is quite respectable. (Kohlhaas & Williams, 1980, p. 34)

For the purposes of this research effort, the grouping or categorization of factors was assumed to be valid and the results appropriate for further analysis and follow-on study.

The criteria in the resulting model, including important additional nominated criteria, were compared with the criteria all commanders perceived to be most important in defining CE organizational effectiveness (expressed in part 3 of the survey questionnaire). Results of this qualitative comparison, which proved unproductive, are presented in Chapter V.

Research Question 3. *How do these criteria differ among*

(a) commanders

(b) commands

(c) bases grouped by base size?

The model created from Research Question 2 is an overall model incorporating the responses of all respondents to the questionnaire. However, as shown in Chapter IV, the levels of importance associated with some of the criteria on the questionnaire were dependent upon the respondent's demographic classification. For example, base civil engineers generally considered "management of the CE budget" to be less important in defining unit organizational effectiveness than did wing commanders.

In order to answer Research Question 3, the authors compared the mean levels of importance for the criteria in each of the factors of the functional model. Comparisons were made based upon the demographic classifications of the respondents. Results of these comparisons are presented in Chapter V.

CHAPTER IV

RESULTS

Introduction

This chapter presents a description of the data collected by the survey questionnaires. Statistics were calculated using the FREQUENCY and ANOVA subroutines of SPSS. The results presented in this chapter represent only the data from the questionnaires and do not include the results of the factor analysis.

Presentation of Data

The results of the questionnaire are presented in the sequence answered in the research questionnaire, that is, demographic data, suggested criteria, most important criteria, and perceived organizational effectiveness. Two hundred forty-five surveys were distributed. Two hundred four surveys, representing 83.3 percent of the total population, were returned.

Demographic Data

The demographic breakdown of the returned surveys is shown in Tables 4.1 through 4.3. One item of demographic data not presented in these three tables is whether a major air command or numbered air force headquarters is located

TABLE 4.1

RETURN RATE OF SURVEY RESPONDENTS BY POSITION OF COMMAND

Commander	Number Distributed	Number Returned	Percent
Wing Commander	77	64	83.1
Base Commander	84	66	78.6
Base Civil Engineer	84	65	77.4
Other	0	9	N/A
Total	245	204	83.3

TABLE 4.2

RETURN RATE OF SURVEY RESPONDENTS BY BASE SIZE

Base Size	Number Distributed	Number Returned	Percent
Large	80	66	82.5
Medium	113	93	82.3
Small	52	45	86.5
Total	245	204	83.3

TABLE 4.3

RETURN RATE OF SURVEY RESPONDENTS BY COMMAND

Command	Number Distributed	Number Returned	Percent
AFLC	17	13	76.5
AFSC	12*	14*	116.7*
ATC	42	37	88.1
MAC	37	32	86.5
SAC	77	61	79.2
TAC	57	44	77.2
Other	3	2	66.7
Unknown	0	1	N/A
Total	245	204	83.3

* This discrepancy is attributed to changes in base alignment after publication of this study's reference (Guide to USAF Bases at Home and Abroad, 1981).

at the respondent's base. Fifty-two respondents indicated that at least one of these organizations was present at their bases. Although this information was not used in this research, it may be of use in future research efforts.

Thirty-Seven Suggested Criteria

Tables 4.4 through 4.7 show the mean level of importance (0 = no comment, 1 = of no importance, 2 = of slight importance, 3 = moderately important, 4 = very important, and 5 = essential) in defining organizational effectiveness assigned to each of the criteria. The comments sections of Tables 4.5 through 4.7 identify statistically significant differences (at a 95 percent confidence level)

TABLE 4.4

MEAN LEVELS OF IMPORTANCE FROM ALL RESPONDENTS

Criterion Number	Criterion Description	Mean Level of Importance
1	Personnel Assigned	4.186
2	Public Relations	3.716
3	Budget	4.632
4	Supervision	4.583
5	Inspection Ratings	3.196
6	MBO	2.809
7	MFH	4.074
8	Energy Conservation	3.598
9	Materials	4.559
10	OJT	4.108
11	Housing Referral	3.304
12	IWP	3.515
13	Vehicles	4.240
14	Commitment	4.520
15	Fire Protection	4.549
16	Fire Crash/Rescue	4.627
17	Utilities	4.333
18	Morale	4.309
19	IE	3.265
20	U-Fix-It	3.005
21	Productivity	4.425

TABLE 4.4--Continued

Criterion Number	Criterion Description	Mean Level of Importance
22	Real Estate	3.304
23	Readiness	4.377
24	Image	4.118
25	Cooperation	4.358
26	Safety	4.230
27	Customer Satisfaction	4.289
28	Engineers	4.005
29	Base Appearance	4.098
30	Leadership	4.804
31	Schedule Compliance	3.676
32	RMP	3.936
33	Contracted Work	4.279
34	Maintenance and Repair	3.853
35	Retention	3.892
36	Design	4.221
37	Airfield Maintenance	4.275

TABLE 4.5

MEAN LEVELS OF IMPORTANCE BY COMMANDER

Criterion Number	Criterion Description	Overall Mean	WC[1]	BC[2]	BCE[3]	Comments[4]
1	Personnel Assigned	4.186	4.25	4.17	4.19	
2	Public Relations	3.716	3.41	3.73	3.98	a
3	Budget	4.632	4.72	4.71	4.48	b
4	Supervision	4.583	4.63	4.51	4.68	
5	Inspection Ratings	3.196	3.25	3.18	3.27	
6	MBO	2.809	3.03	3.03	2.72	
7	MFH	4.074	4.17	4.20	4.12	
8	Energy Conservation	3.598	3.67	3.62	3.55	
9	Materials	4.559	4.36	4.53	4.74	b
10	OJT	4.108	4.30	4.05	4.11	c
11	Housing Referral	3.304	3.13	3.56	3.32	c
12	IWP	3.515	3.64	3.70	3.29	b
13	Vehicles	4.240	4.05	4.20	4.55	b
14	Commitment	4.520	4.53	4.47	4.58	
15	Fire Protection	4.549	4.53	4.68	4.59	
16	Fire Crash/Rescue	4.627	4.64	4.81	4.73	
17	Utilities	4.333	4.31	4.50	4.52	
18	Morale	4.309	4.31	4.21	4.38	
19	IE	3.265	3.40	3.40	3.25	
20	U-Fix-It	3.005	3.34	3.30	2.82	b
21	Productivity	4.425	4.47	4.42	4.35	
22	Real Estate	3.304	3.42	3.45	3.29	

1. WC: wing commanders.
2. BC: base commanders.
3. BCE: base civil engineers.
4. a: no statistically significant difference between BC and BCE.
   b: no statistically significant difference between WC and BC.
   c: statistically significant difference between WC and BC.

Note: significant differences are at a 95 percent confidence level.

TABLE 4.5--Continued

Criterion Number	Criterion Description	Overall Mean	WC[1]	BC[2]	BCE[3]	Comments[4]
23	Readiness	4.377	4.44	4.32	4.51	
24	Image	4.118	4.00	4.05	4.32	b
25	Cooperation	4.358	4.17	4.27	4.58	b
26	Safety	4.230	4.31	4.09	4.34	
27	Customer Satisfaction	4.289	4.27	4.18	4.37	
28	Engineers	4.005	4.02	4.14	4.06	
29	Base Appearance	4.098	4.16	4.15	3.95	
30	Leadership	4.804	4.81	4.82	4.77	
31	Schedule Compliance	3.676	3.75	3.73	3.58	
32	RMP	3.936	4.00	3.94	3.95	
33	Contracted Work	4.279	4.41	4.38	4.14	b
34	Maintenance and Repair	3.853	3.92	3.88	3.92	
35	Retention	3.892	3.91	3.89	3.94	
36	Design	4.221	4.25	4.32	4.18	
37	Airfield Maintenance	4.275	4.43	4.46	4.47	

1. WC: wing commanders.
2. BC: base commanders.
3. BCE: base civil engineers.
4. b: no statistically significant difference between WC and BC.

<u>Note</u>: significant differences are at a 95 percent confidence level.

TABLE 4.6

MEAN LEVELS OF IMPORTANCE BY BASE SIZE

Criterion Number	Criterion Description	Overall Mean	Large Bases	Medium Bases	Small Bases	Comments
1	Personnel Assigned	4.186	4.18	4.19	4.24	
2	Public Relations	3.716	3.91	3.70	3.61	
3	Budget	4.632	4.62	4.66	4.61	
4	Supervision	4.583	4.69	4.55	4.63	
5	Inspection Ratings	3.196	3.29	3.26	3.18	
6	MBO	2.809	2.75	3.01	2.83	
7	MFH	4.074	4.28	4.13	4.11	
8	Energy Conservation	3.598	3.64	3.59	3.58	
9	Materials	4.559	4.60	4.47	4.65	
10	OJT	4.108	4.23	4.16	4.08	
11	Housing Referral	3.304	3.27	3.43	3.20	
12	IWP	3.515	3.51	3.51	3.58	
13	Vehicles	4.240	4.20	4.27	4.29	
14	Commitment	4.520	4.59	4.57	4.47	
15	Fire Protection	4.549	4.61	4.56	4.63	
16	Fire Crash/Rescue	4.627	4.81	4.66	4.75	

TABLE 4.6--Continued

Criterion Number	Criterion Description	Overall Mean	Large Bases	Medium Bases	Small Bases	Comments[1]
17	Utilities	4.333	4.58	4.34	4.50	a
18	Morale	4.309	4.36	4.23	4.39	
19	IE	3.265	3.36	3.37	3.31	
20	U-Fix-It	3.005	3.32	3.14	3.08	
21	Productivity	4.425	4.49	4.40	4.41	
22	Real Estate	3.304	3.40	3.32	3.43	
23	Readiness	4.377	4.33	4.51	4.36	
24	Image	4.118	4.13	4.12	4.17	
25	Cooperation	4.358	4.38	4.37	4.33	
26	Safety	4.230	4.27	4.29	4.12	
27	Customer Satisfaction	4.289	4.33	4.32	4.21	
28	Engineers	4.005	4.09	4.08	4.03	
29	Base Appearance	4.098	4.16	4.03	4.15	
30	Leadership	4.804	4.76	4.84	4.79	
31	Schedule Compliance	3.676	3.69	3.66	3.70	
32	RMP	3.936	4.09	3.96	3.86	

1. a: statistically significant difference between large and medium bases.

Note: significant differences are at a 95 percent confidence level.

TABLE 4.6--*Continued*

Criterion Number	Criterion Description	Overall Mean	Large Bases	Medium Bases	Small Bases	Comments[1]
33	Contracted Work	4.279	4.29	4.32	4.28	
34	Maintenance and Repair	3.853	3.89	3.94	3.83	
35	Retention	3.892	3.91	3.94	3.82	
36	Design	4.221	4.33	4.22	4.22	
37	Airfield Maintenance	4.275	4.67	4.46	4.36	b

1. b: statistically significant difference between large and medium bases.

Note: significant differences are at a 95 percent confidence level.

TABLE 4.7

MEAN LEVELS OF IMPORTANCE BY COMMAND

Criterion Number	Criterion Description	Overall Mean	ATC	MAC	SAC	TAC	Other[1]	Comments[2]
1	Personnel Assigned	4.186	4.27	4.16	4.16	4.36	4.03	
2	Public Relations	3.716	3.89	3.56	3.69	3.80	3.60	
3	Budget	4.632	4.59	4.75	4.77	4.45	4.53	a, b
4	Supervision	4.583	4.59	4.59	4.67	4.56	4.57	
5	Inspection Ratings	3.196	3.22	3.06	3.35	3.23	3.27	
6	MBO	2.809	2.27	3.35	2.96	2.93	3.00	c
7	MFH	4.074	4.14	4.16	4.23	4.07	4.13	
8	Energy Conservation	3.598	3.81	3.84	3.38	3.55	3.60	d, e
9	Materials	4.559	4.54	4.56	4.44	4.59	4.77	f
10	OJT	4.108	4.19	4.13	4.33	4.00	3.97	b, f

1. The "other" group includes AFSC and AFLC responses.
2. a: statistically significant difference between TAC and MAC.
   b: statistically significant difference between TAC AND SAC.
   c: statistically significant difference between ATC and all other groups.
   d: statistically significant difference between SAC and ATC.
   e: statistically significant difference between SAC and MAC.
   f: statistically significant difference between SAC and "Other."

Note: significant differences are at a 95 percent confidence level.

TABLE 4.7--Continued

Criterion Number	Criterion Description	Overall Mean	ATC	MAC	SAC	TAC	Other[1]	Comments[2]
11	Housing Referral	3.304	3.38	3.22	3.28	3.42	3.30	
12	IWP	3.515	3.51	3.56	3.48	3.53	3.63	
13	Vehicles	4.240	4.19	4.25	4.30	4.27	4.28	
14	Commitment	4.520	4.49	4.44	4.56	4.66	4.52	
15	Fire Protection	4.549	4.70	4.56	4.69	4.44	4.52	
16	Fire Crash/Rescue	4.627	4.78	4.69	4.74	4.67	4.70	
17	Utilities	4.333	4.49	4.38	4.55	4.31	4.43	
18	Morale	4.309	4.35	4.31	4.26	4.32	4.33	
19	IE	3.265	3.46	3.53	3.32	3.31	3.10	
20	U-Fix-It	3.005	2.81	3.06	3.11	3.74	2.93	g
21	Productivity	4.425	4.32	4.41	4.48	4.52	4.30	
22	Real Estate	3.304	3.49	3.31	3.33	3.36	3.38	
23	Readiness	4.377	4.51	4.53	4.36	4.44	4.28	
24	Image	4.118	4.16	4.19	4.03	4.14	4.27	
25	Cooperation	4.358	4.41	4.31	4.36	4.27	4.47	
26	Safety	4.230	4.11	4.41	4.33	4.20	4.03	

1. The "other" group includes AFSC and AFLC responses.
2. g: statistically significant difference between TAC and all other groups.

Note: statistically significant differences are at a 95 percent confidence level.

TABLE 4.7--Continued

Criterion Number	Criterion Description	Overall Mean	ATC	MAC	SAC	TAC	Other[1]	Comments[2]
27	Customer Satisfaction	4.289	4.19	4.31	4.31	4.34	4.27	
28	Engineers	4.005	3.97	4.09	4.10	4.14	3.97	
29	Base Appearance	4.098	4.03	4.09	4.05	4.25	4.07	
30	Leadership	4.804	4.73	4.78	4.89	4.84	4.70	
31	Schedule Compliance	3.676	3.51	3.63	3.82	3.59	3.77	d
32	RMP	3.936	3.92	4.06	4.00	3.84	3.97	
33	Contracted Work	4.279	4.11	4.41	4.49	4.09	4.33	b, d
34	Maintenance and Repair	3.853	3.81	3.84	4.13	3.79	3.70	b, f
35	Retention	3.892	3.86	3.94	3.95	3.91	3.73	
36	Design	4.221	4.22	4.22	4.36	4.26	4.03	f
37	Airfield Maintenance	4.275	4.35	4.66	4.52	4.37	4.50	

1. The "other" group includes AFSC and AFLC responses.

2. b: statistically significant difference between TAC and SAC.
   d: statistically significant difference between SAC and ATC.
   f: statistically significant difference between SAC and "Other."

Note: significant differences are at a 95 percent confidence level.

between the mean responses of each group. Where no such difference existed, the comments section was left blank. For example, no comment after criterion 1 (Personnel Assigned) in Table 4.5 indicates there is no statistically significant difference between the three commanders' perceptions of the importance of criterion 1 in defining organizational effectiveness within base level civil engineering organizations. However, for criterion 10 (OJT), there was a significant difference between the perceptions of wing commanders and base commanders. Wing commanders perceived OJT as more important in defining organizational effectiveness than did base commanders.

The data presented in Table 4.7 shows the mean level of importance commanders assigned to each criterion by major air command. Because of the limited number of responses from AFSC and AFLC bases, responses from these commands were included in the "other" group. This resulted in a large enough sample size in all five groups or commands to permit statistical analysis.

Criteria Perceived to be Most Important

In part 3 of the survey questionnaire, respondents were asked to rank order the five criteria they perceived to be most important in defining organizational effectiveness within base level civil engineering organizations. Using the weighted value technique described in Chapter III, point values were determined for each of the criteria on the following basis:

1. Five points for each time a criterion was selected as most important,

2. Four points for each time a criterion was selected as second most important,

3. Three points for each time a criterion was selected as third most important,

4. Two points for each time a criterion was selected as fourth most important,

5. One point for each time a criterion was selected as fifth most important.

Total points for each of the thirty-seven original criteria are shown in Table 4.8. The five criteria with the highest total point values were defined to be the five criteria most important in defining organizational effectiveness. These criteria are shown in Tables 4.9 through 4.12.

Because respondents were asked to select the five most important criteria, only the criteria in Tables 4.9 through 4.12 were compared with the model developed from the content analysis. Discussion of these comparisons is presented in Chapter V.

TABLE 4.8

POINT VALUES FOR MOST IMPORTANT CRITERIA

Criterion Number	Criterion Description	Total Points Value
1	Personnel Assigned	71
2	Public Relations	27
3	Budget	209
4	Supervision	174
5	Inspection Ratings	54
6	MBO	10
7	MFH	17
8	Energy Conservation	3
9	Materials	117
10	OJT	49
11	Housing Referral	2
12	IWP	16
13	Vehicles	23
14	Commitment	227
15	Fire Protection	56
16	Fire Crash/Rescue	60
17	Utilities	41
18	Morale	129
19	IE	10
20	U-Fix-It	5
21	Productivity	204
22	Real Estate	0
23	Readiness	188
24	Image	7
25	Cooperation	68
26	Safety	15
27	Customer Satisfaction	58
28	Engineers	26

TABLE 4.8--Continued

Criterion Number	Criterion Description	Total Points Value
29	Base Appearance	27
30	Leadership	549
31	Schedule Compliance	2
32	RMP	13
33	Contracted Work	43
34	Maintenance and Repair	14
35	Retention	33
36	Design	30
37	Airfield Maintenance	41

TABLE 4.9

FIVE CRITERIA PERCEIVED MOST IMPORTANT
BY ALL RESPONDENTS

Criterion Number	Criterion Description	Level of Importance	Total Points[1]
30	Leadership	First	549
14	Commitment	Second	227
3	Budget	Third	209
21	Productivity	Fourth	204
23	Readiness	Fifth	188

1. Only three other criteria earned more than 100 points: supervision (174), morale (129), and materials (117).

TABLE 4.10

FIVE CRITERIA PERCEIVED MOST IMPORTANT BY POSITION OF COMMAND

Wing Commander			Base Commander			Base Civil Engineer			
Criterion Number	Criterion Description	Total Points	Criterion Number	Criterion Description	Total Points	Criterion Number	Criterion Description	Total Points	Level of Importance
30	Leadership	186	30	Leadership	177	30	Leadership	165	First
3	Budget	94	3	Budget	82	14	Commitment	70	Second
14	Commitment	86	21	Productivity	80	23	Readiness	59	Third
21	Productivity	73	23	Readiness	61	9	Materials	56	Fourth
4	Supervision	68	14	Commitment	58	18	Morale	56	Fifth

TABLE 4.11

FIVE CRITERIA PERCEIVED MOST IMPORTANT BY BASE SIZE

Small Bases			Medium Bases			Large Bases			
Criterion Number	Criterion Description	Total Points	Criterion Number	Criterion Description	Total Points	Criterion Number	Criterion Description	Total Points	Level of Importance
30	Leadership	121	30	Leadership	276	30	Leadership	152	First
14	Commitment	63	3	Budget	106	23	Readiness	67	Second
21	Productivity	52	23	Readiness	99	14	Commitment	66	Third
3	Budget	50	14	Commitment	98	21	Productivity	57	Fourth
4	Supervision	48	21	Productivity	94	3	Budget	53	Fifth

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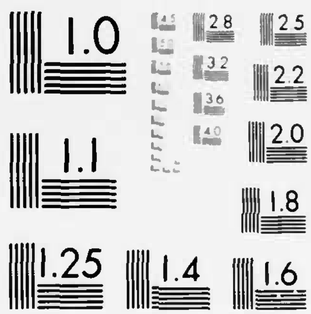

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TABLE 4.12

FIVE CRITERIA PERCEIVED MOST IMPORTANT BY COMMAND

ATC			MAC			SAC			
Criterion Number	Criterion Description	Total Points	Criterion Number	Criterion Description	Total Points	Criterion Number	Criterion Description	Total Points	Level of Importance
30	Leadership	82	30	Leadership	85	30	Leadership	181	First
14	Commitment	47	23	Readiness	45	3	Budget	86	Second
23	Readiness	36	21	Productivity	38	21	Productivity	72	Third
4	Supervision	35	3	Budget	34	14	Commitment	67	Fourth
5	Inspection Ratings	28	4	Supervision	34	4	Supervision	57	Fifth

TAC			Other			
Criterion Number	Criterion Description	Total Points	Criterion Number	Criterion Description	Total Points	Level of Importance
30	Leadership	126	30	Leadership	70	First
14	Commitment	72	9	Materials	27	Second
23	Readiness	41	21	Productivity	26	Third
21	Productivity	40	14	Commitment	26	Fourth
3	Budget	36	3	Budget	26	Fifth

Perceived Effectiveness

Part 4 of the survey questionnaire asked respondents to rate the effectiveness of their respective civil engineering organizations on a segmented scale ranging from 0 to 100 percent effective. This rating was used as the dependent variable in the regression analysis. Tables 4.13 through 4.15 show the mean perceived effectiveness by respondents according to their position of command, base size, and major air command. ANOVA analyses were run against the means for each group (using the Duncan's multiple range test with a confidence level of 0.95). The results of these tests are shown in the comments portion of the respective tables.

TABLE 4.13

MEAN EFFECTIVENESS RATING BY POSITION OF COMMAND

	Position of Command			
	Wing Commander	Base Commander	Base Civil Engineer	Comments
Mean Effectiveness Rating (%)	66.95	68.53	71.77	No significant difference between any groups

Note: significant differences are at a 95 percent confidence level.

TABLE 4.14

MEAN EFFECTIVENESS RATING BY BASE SIZE

	Base Size			
	Small	Medium	Large	Comments
Mean Effec-tiveness Rating (%)	66.73	68.01	72.05	No significant difference between any groups

Note: significant differences are at a 95 percent confidence level.

TABLE 4.15

MEAN EFFECTIVENESS RATING BY MAJOR AIR COMMAND

	Major Air Command					
	ATC	MAC	SAC	TAC	Other*	Comments
Mean Effec-tiveness Rating (%)	67.38	75.63	64.34	72.95	67.83	Significant difference between SAC & TAC; SAC & MAC

* The "other" category includes responses from AFLC and AFSC bases because of statistically small number of responses from those bases.

Note: significant differences are at a 95 percent confidence level.

CHAPTER V

ANALYSIS AND DISCUSSION

Introduction

This chapter contains the analysis of the survey data to answer each of the research questions. Each research question is analyzed separately.

The procedures described in Chapter III revealed which criteria were perceived to be important in defining organizational effectiveness within base level civil engineering organizations. A functional model to define effectiveness was then developed from that information.

In addition, this chapter contains a qualitative comparison of the importance of the criteria in each factor of the model based upon the demographics of the various respondents.

Research Question 1

What criteria (characteristics or traits) define organizational effectiveness within base level civil engineering organizations?

Because the survey questionnaire contained two sources of criteria to define organizational effectiveness, both sources were evaluated in answering this research question. The first source of criteria was the thirty-seven criteria contained in part 2 of the questionnaire. All criteria whose mean level of importance was greater than the overall mean less one standard deviation were considered to be important in defining organizational effectiveness within base level civil engineering organizations.

The overall mean level of importance for all thirty-seven criteria was 4.034, and the standard deviation was 0.498. Therefore, only the criteria whose mean level of importance was greater than 3.536 were selected. As a result of the Likert scale used (0 = no comment, 1 = of no importance, 2 = of slight importance, 3 = moderately important, 4 = very important, 5 = essential), this procedure eliminated criteria which were considered of either no importance or of only slight importance in defining organizational effectiveness. Thus, only criteria perceived to be essential, very important, or highly moderately important in defining organizational effectiveness for base level civil engineering organizations were retained.

Table 5.1 shows the mean level of importance for each of the thirty-seven criteria offered to the respondents. The table is arranged in decreasing level of importance.

The second source of criteria was the additional criteria nominated by survey respondents in part 3 of the questionnaire. In accordance with the selection procedure

TABLE 5.1

DESCENDING MEAN LEVELS OF IMPORTANCE FOR ORIGINAL CRITERIA

Criterion Number	Criterion Description	Mean Level of Importance
30	Leadership	4.804
3	Budget	4.632
16	Fire Crash/Rescue	4.627
4	Supervision	4.583
9	Materials	4.559
15	Fire Protection	4.549
14	Commitment	4.520
21	Productivity	4.425
23	Readiness	4.377
25	Cooperation	4.358
17	Utilities	4.333
18	Morale	4.309
27	Customer Satisfaction	4.289
33	Contracted Work	4.279
37	Airfield Maintenance	4.275
13	Vehicles	4.240
26	Safety	4.230
36	Design	4.221
1	Personnel Assigned	4.186
24	Image	4.118
10	OJT	4.108

TABLE 5.1--Continued

Criterion Number	Criterion Description	Mean Level of Importance
29	Base Appearance	4.098
7	MFH	4.074
28	Engineers	4.005
32	RMP	3.936
35	Retention	3.892
34	Maintenance and Repair	3.853
2	Public Relations	3.716
31	Schedule Compliance	3.676
8	Energy Conservation	3.598
12	IWP*	3.515
11	Housing Referral*	3.304
22	Real Estate*	3.304
19	IE*	3.265
5	Inspection Ratings*	3.196
20	U-Fix-It*	3.005
6	MBO*	2.809

* Not included in definition developed by this study.

described in Chapter III, three of the nominated criteria were considered important in defining civil engineering organizational effectiveness. These additional criteria included in the definition were:

1. Responsiveness
2. Effective communication
3. Recognition (of personnel).

A complete list of the nominated criteria is included in Appendix I.

A list of the thirty-three criteria that wing commanders, base commanders, and base civil engineers perceived to be important in defining organizational effectiveness within base level civil engineering organizations is shown in Table 5.2.

Research Question 2

How can these criteria be incorporated into an overall model to define organizational effectiveness within base level civil engineering organizations?

Because the criteria from Research Question 1 were not linearly related to the dependent variable (perceived organizational effectiveness) and because the factors created from factor analysis were not intuitively interpretable, content analysis (as described in Chapter III) was used to create a functional model of organizational effectiveness within base level civil engineering

TABLE 5.2

CRITERIA THAT DEFINE CE ORGANIZATIONAL EFFECTIVENESS

Criterion Number	Criterion Description
1	Number of personnel assigned versus authorized
2	Public relations effort by civil engineering
3	Management of civil engineering budget
4	Supervision of Operations workforce
7	Maintenance of military family housing
8	Emphasis on energy conservation
9	Material availability
10	Quality of OJT programs
13	Sufficient number of vehicles
14	Commitment of personnel
15	Fire protection capability
16	Fire rescue/crash capability
17	Utility system operation
18	Organizational morale
21	Workforce productivity
23	Readiness capability
24	Professional image of CE customer service
25	Cooperation between branches in CE
26	Personnel and vehicle safety
27	Customer satisfaction
28	Management of engineers and draftsmen
29	Base appearance

TABLE 5.2--Continued

Criterion Number	Criterion Description
30	Leadership of CE commander and supervisors
31	Weekly schedule compliance
32	Integrity of recurring maintenance program
33	Accuracy of contract work requirements
34	Identification of maintenance and repair work by contract
35	Retention of personnel
36	Accuracy of Design program
37	Airfield maintenance
*	Responsiveness
*	Effective communication up the chain of command
*	Recognition of personnel

* Nominated by respondents.

organizations. The model was created from the thirty-three criteria (from Research Question 1) determined to be important in defining CE organizational effectiveness.

The factors from the content analysis are described below and listed in descending levels of importance. The importance level for each factor (shown in parenthesis after each factor title) is the average perceived level of importance of the criteria included in that factor.

Factor 1: Fire Protection (4.588)

Criterion

15 (Fire Protection Capability)

16 (Fire Crash/Rescue Capability)

Factor 2: Leadership (4.464)

Criterion

4 (Supervision of Operations Workforce)

28 (Management of Engineers and Draftsmen)

30 (Leadership)

Factor 3: Readiness (4.377)

Criterion

23 (Readiness Capability)

Factor 4: Resource Availability (4.328)

Criterion

1 (Number of Personnel Assigned vs Authorized)

9 (Material Availability)

13 (Sufficient Number of Vehicles)

Factor 5: Organizational Health (4.269)

Criterion

14 (Commitment of Personnel)

18 (Organizational Morale)

25 (Cooperation between CE Branches)

35 (Retention of Personnel)

* (Communication up and down the chain of command)

* (Recognition)

* nominated by respondents

Factor 6: Program Management (4.142)

Criterion

3 (Management of the CE Budget)

8 (Emphasis on Energy Conservation)

10 (Quality of OJT Programs)

26 (Personnel and Vehicle Safety)

Factor 7: Contract Management (4.117)

Criterion

33 (Accuracy of Contract Work Descriptions)

34 (Identification of Maintenance and Repair Work by Contract)

36 (Accuracy of Engineering Design Program)

Factor 8: Operations Workforce Performance (4.117)

Criterion

7 (Maintenance of Military Family Housing)

17 (Utility System Operation)

21 (Workforce Productivity)

Factor 8--Continued

Criterion

29 (Base Appearance)

31 (Weekly Schedule Compliance)

32 (Integrity of RMP Program)

37 (Airfield Maintenance)

Factor 9: Customer Image (4.041)

Criterion

2 (Public Relations Effort of CE)

24 (Professional Image of CE Customer Service Unit)

27 (Customer Satisfaction)

* (Responsiveness)

* nominated by respondents

Therefore, according to the analysis of responses, the overall model which defines organizational effectiveness within base level civil engineering organizations is

OE = f(F1, F2, F3, F4, F5, F6, F7, F8, and F9)

where F1 = Fire Protection

F2 = Leadership

F3 = Readiness

F4 = Resource Availability

F5 = Organizational Health

F6 = Program Management

F7 = Contract Management

F8 = Operations Workforce Performance

F9 = Customer Image

The five criteria considered most important by all respondents were (1) leadership, (2) commitment, (3) budget, (4) productivity, and (5) readiness. Although of no value in the model development, all five of these criteria are included in the above model.

Discussion of Factors

The following discussion is meant to provide further insight into each of the nine factors of the functional model.

Factor 1, fire protection, contains only two criteria, both of which refer to the ability of the base fire department to respond to either a facility or an airfield emergency. Although this factor does not include any criteria relating to the inspection or prevention programs within the fire department, this lack may be attributed to a shortcoming in the questionnaire rather than a reflection of the perceptions of the survey respondents.

Factor 2 is titled leadership. In addition to leadership, this factor includes the criteria of supervision of the operations workforce and management of the engineers and draftsmen. Based upon responses from the questionnaires, leadership was the criterion considered most important by all respondents, regardless of demographic classification. The factor, leadership, refers not only to the personal leadership of the base civil engineer but to the leadership demonstrated at all levels within the entire organization.

The third factor in this functional model is readiness. Readiness is not limited to the organization's ability to perform its day-to-day mission (e.g., service calls, job orders); it also denotes the organization's capability to perform its wartime commitments (e.g., rapid runway repair, bomb damage repair, base recovery after attack).

The fourth factor, resource availability, deals with resources available to the organization to perform its primary mission. In addition to materials, resources include vehicles and personnel. Inherent in this factor is the correct quantity and quality of materials; number, type and maintenance of vehicles; and number and skills of the personnel assigned. Although no reference was made in the survey questionnaire to equipment availability, equipment might be considered an important type of resource included in resource availability.

Organizational health, factor 5, refers to those activities in the organization that either directly or indirectly affect the attitudes of the individuals within the organization. Criteria included in this factor are commitment of personnel, organizational morale, cooperation between CE branches, retention of personnel, communication up and down the chain of command, and recognition. Each of these activities may be directly affected by the efforts of the BCE and his/her subordinate supervisors.

Recognition and communication were not originally suggested criteria but were nominated by respondents as important in defining organizational effectiveness. As expressed by commanders in response to the open-ended comments in part 3 of the questionnaire, recognition refers to the activities of squadron leaders (at all levels) to ensure that efforts of individuals are recognized and rewarded. (Appendix I contains commanders' open-ended comments.) Several open-ended comments relate to the need for good communication between the CE squadron and other organizations on base, as well as commanders within their chain of command.

Factor 6, program management, is associated with the administration of programs within the civil engineering organization. All Air Force organizations must plan their annual budget requirements, train their personnel, be concerned with all aspects of safety, and promote energy awareness. Although not unique to civil engineering, respondents perceived these criteria to be important in defining organizational effectiveness within base level civil engineering organizations.

Factor 7, contract management, relates to civil engineering activities performed by civilian contractors. It includes both the identification of contract type work and the accuracy of the descriptions for that work. In addition, criterion 36 (accuracy of the engineering design program) highlights the need for adequate management of the design schedule once the contract work has been identified and adequate descriptions have been prepared.

Factor 8, operations workforce performance, refers to the direct labor activities of the operations workforce in civil engineering. This factor includes operations type work performed on a daily basis (i.e., recurring maintenance [RMP] and utility plant operations) as well as services type work (MFH and airfield maintenance) performed on an as-required or requested basis. Because this factor deals with the actual performance of CE personnel, productivity and schedule compliance are important criteria in defining this factor. The reader should note that the need for increased productivity was frequently mentioned by base and wing commanders as important in their perceptions of effectiveness within their civil engineering organizations.

The last factor, customer image, refers to all of the conscious actions of the organization and its members to influence the opinions of its customers. It includes the conduct of CE personnel, as well as the results of the work they accomplish (or fail to accomplish). Based upon the open-ended comments, responsiveness (the most frequently nominated criterion) includes the squadron's ability to respond to normal work requests as well as requests from various levels of command.

Research Question 3

How do these criteria differ among

(a) commanders

(b) commands

(c) bases grouped by size?

Tables 5.3 through 5.5 show the differences in the perceived levels of importance for the criteria within each of the factors of the functional model. Table 5.3 shows differences among wing commanders (WCs), base commanders (BCs), and base civil engineers (BCEs); Table 5.4 shows differences among commands (ATC, MAC, SAC, TAC, and other); and Table 5.5 shows differences among large, medium, and small bases. These differences were obtained from the analysis described in Chapter IV. Differences described in the tables identify those criteria for which there is a statistically significant difference in the mean levels of importance based upon demographic classification. Although there is no change in the functional model as a result of these differences in perceptions, they may be significant in future efforts to refine and/or validate this model.

TABLE 5.3

DIFFERENCES IN CRITERIA AMONG COMMANDERS

Factor 1: Fire Protection

Criterion

15 (Fire Protection Capability)

16 (Fire Crash/Rescue Capability)

Factor 2: Leadership

Criterion

4 (Supervision of Operations Workforce)

28 (Management of Engineers and Draftsmen)

30 (Leadership)

Factor 3: Readiness

Criterion

23 (Readiness Capability)

Factor 4: Resource Availability

Criterion

1 (Number of Personnel Assigned vs Authorized)

9 (Material Availability)[a]

13 (Sufficient Number of Vehicles)

Factor 5: Organizational Health

Criterion

14 (Commitment of Personnel)

a. Perceived as more important by base civil engineers than wing or base commanders.

TABLE 5.3--Continued

Factor 5--Continued

Criterion

18 (Organizational Morale)

25 (Cooperation Between CE Branches)[a]

35 (Retention of Personnel)

(Communication Up and Down the chain of command)

(Recognition)

Factor 6: Program Management

Criterion

3 (Management of the CE Budget)[b]

8 (Emphasis on Energy Conservation)

10 (Quality of OJT Programs)[c]

26 (Personnel and Vehicle Safety)

Factor 7: Contract Management

Criterion

33 (Accuracy of Contract Work Descriptions)[b]

34 (Identification of Maintenance and Repair Work by Contract)

36 (Accuracy of Engineering Design Program)

a. Perceived as more important by base civil engineers than wing or base commanders.

b. Perceived as less important by base civil engineers than wing or base commanders.

c. Perceived as more important by wing commanders than base commanders.

TABLE 5.3--Continued

Factor 8: Operations Workforce Performance	
Criterion	
7	(Maintenance of Military Family Housing)
17	(Utility System Operation)
21	(Workforce Productivity)
29	(Base Appearance)
31	(Weekly Schedule Compliance)
32	(Integrity of RMP Program)
37	(Airfield Maintenance)
Factor 9: Customer Image	
Criterion	
2	(Public Relations Effort of CE)[d]
24	(Professional Image of CE Customer Service Unit)[a]
27	(Customer Satisfaction)
	(Responsiveness)

a. Perceived as more important by base civil engineers than wing and base commanders.

d. Perceived as less important by wing commanders than base commanders or base civil engineers.

TABLE 5.4

DIFFERENCES IN CRITERIA AMONG COMMANDS

<u>Factor 1: Fire Protection</u>

<u>Criterion</u>

15 (Fire Protection Capability)

16 (Fire Crash/Rescue Capability)

<u>Factor 2: Leadership</u>

<u>Criterion</u>

4 (Supervision of Operations Workforce)

28 (Management of Engineers and Draftsmen)

30 (Leadership)

<u>Factor 3: Readiness</u>

<u>Criterion</u>

23 (Readiness Capability)

<u>Factor 4: Resource Availability</u>

<u>Criterion</u>

1 (Number of Personnel Assigned vs Authorized)

9 (Material Availability)[a]

13 (Sufficient Number of Vehicles)

<u>Factor 5: Organizational Health</u>

14 (Commitment of Personnel)

a. Perceived to be less important by SAC than "other."

TABLE 5.4--Continued

Factor 5--Continued

Criterion

18 (Organization Morale)

25 (Cooperation Between CE Branches)

35 (Retention of Personnel)

(Communication Up and Down the chain of command)

(Recognition)

Factor 6: Program Management

Criterion

3 (Management of the CE Budget)[b]

8 (Emphasis on Energy Conservation)[c]

10 (Quality of OJT Programs)[d]

26 (Personnel and Vehicle Safety)

Factor 7: Contract Management

Criterion

33 (Accuracy of Contract Work Descriptions)[e]

34 (Identification of Maintenance and Repair Work by Contract)[d]

b. Perceived to be less important by TAC than SAC or MAC.

c. Perceived to be less important by SAC than MAC or ATC.

d. Perceived to be more important by SAC than TAC or "other."

e. Perceived to be more important by SAC than ATC or TAC.

TABLE 5.4--Continued

Factor 7--Continued

Criterion

36 (Accuracy of Engineering Design Program)[f]

Factor 8: Operations Workforce Performance

Criterion

7 (Maintenance of Military Family Housing)

17 (Utility System Operation)

21 (Workforce Productivity)

29 (Base Appearance)

31 (Weekly Schedule Compliance)[g]

32 (Integrity of RMP Program)

37 (Airfield Maintenance)

Factor 9: Customer Image

Criterion

2 (Public Relations Effort of CE)

24 (Professional Image of CE Customer Service Unit)

27 (Customer Satisfaction)

(Responsiveness)

f. Perceived to be more important by SAC than "other."

g. Perceived to be more important by SAC than ATC.

TABLE 5.5

DIFFERENCES IN CRITERIA AMONG LARGE, MEDIUM, AND SMALL BASES

Factor 1: Fire Protection

Criterion

15 (Fire Protection Capability)

16 (Fire Crash/Rescue Capability)

Factor 2: Leadership

Criterion

4 (Supervision of Operations Workforce)

28 (Management of Engineers and Draftsmen)

30 (Leadership)

Factor 3: Readiness

Criterion

23 (Readiness Capability)

Factor 4: Resource Availability

Criterion

1 (Number of Personnel Assigned vs Authorized)

9 (Material Availability)

13 (Sufficient Number of Vehicles)

Factor 5: Organizational Health

Criterion

14 (Commitment of Personnel)

18 (Organizational Morale)

25 (Cooperation Between CE Branches)

TABLE 5.5--Continued

<u>Factor 5--Continued</u>

<u>Criterion</u>

35 (Retention of Personnel)

(Communication Up and Down the chain of command)

(Recognition)

<u>Factor 6: Program Management</u>

<u>Criterion</u>

3 (Management of the CE Budget)

8 (Emphasis on Energy Conservation)

10 (Quality of OJT Programs)

26 (Personnel and Vehicle Safety)

<u>Factor 7: Contract Management</u>

<u>Criterion</u>

33 (Accuracy of Contract Work Descriptions)

34 (Identification of Maintenance and Repair Work by Contract)

36 (Accuracy of Engineering Design Program)

<u>Factor 8: Operations Workforce Performance</u>

<u>Criterion</u>

7 (Maintenance of Military Family Housing)

17 (Utility System Operation)[a]

21 (Workforce Productivity)

a. Perceived to be more important by large bases than medium bases.

TABLE 5.5--Continued

Factor 8--Continued

Criterion

29 (Base Appearance)

31 (Weekly Schedule Compliance)

32 (Integrity of RMP Program)

37 (Airfield Maintenance)[b]

Factor 9: Customer Image

Criterion

2 (Public Relations Effort of CE)

24 (Professional Image of CE Customer Service Unit)

27 (Customer Satisfaction)

(Responsiveness)

b. Perceived to be more important by large bases than small bases.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents the conclusions drawn from the development of a model to define organizational effectiveness within base level civil engineering organizations. Recommendations are presented which will improve the base civil engineer's awareness of senior commanders' perceptions of organizational effectiveness within his/her organization. Problems encountered in this research and recommendations for further research efforts are also presented.

Specific Conclusions

The conclusions discussed below are based upon the assumption that the data obtained in this research effort are representative of the entire population. This assumption is strengthened by the high (83.3 percent) return rate from the commanders surveyed.

As noted in Chapter I, Albanese (1981) identified the need to determine what characteristics or criteria actually define organizational effectiveness prior to any efforts to actually measure the effectiveness of a group. Identification of these criteria was one of the objectives of this research effort. Specific conclusions from this research effort are discussed below:

1. Commanders perceive that the thirty-three criteria listed in Table 5.2, page 91, define organizational effectiveness within base level civil engineering organizations.

2. By content analysis, these criteria may be combined into nine factors to form the effectiveness model shown in Figure 6.1. A discussion of the content of each factor was presented in Chapter V.

3. Within this model, there are differences among commanders in their perceptions of the importance of four criteria. Similar differences in perceptions were discussed by Steers (1976) in his research on organizational effectiveness of groups and organizations (see Chapter II). Base civil engineers perceive management of the CE budget to be less important in defining organizational effectiveness than do wing or base commanders. On the other hand, they perceive the professional image of their customer service units to be more important in this definition than do their superiors. Both base commanders and base civil engineers perceive the public relations efforts of the civil engineering organization to be more important in defining organizational effectiveness than do wing commanders. Wing commanders, however, perceive the quality of

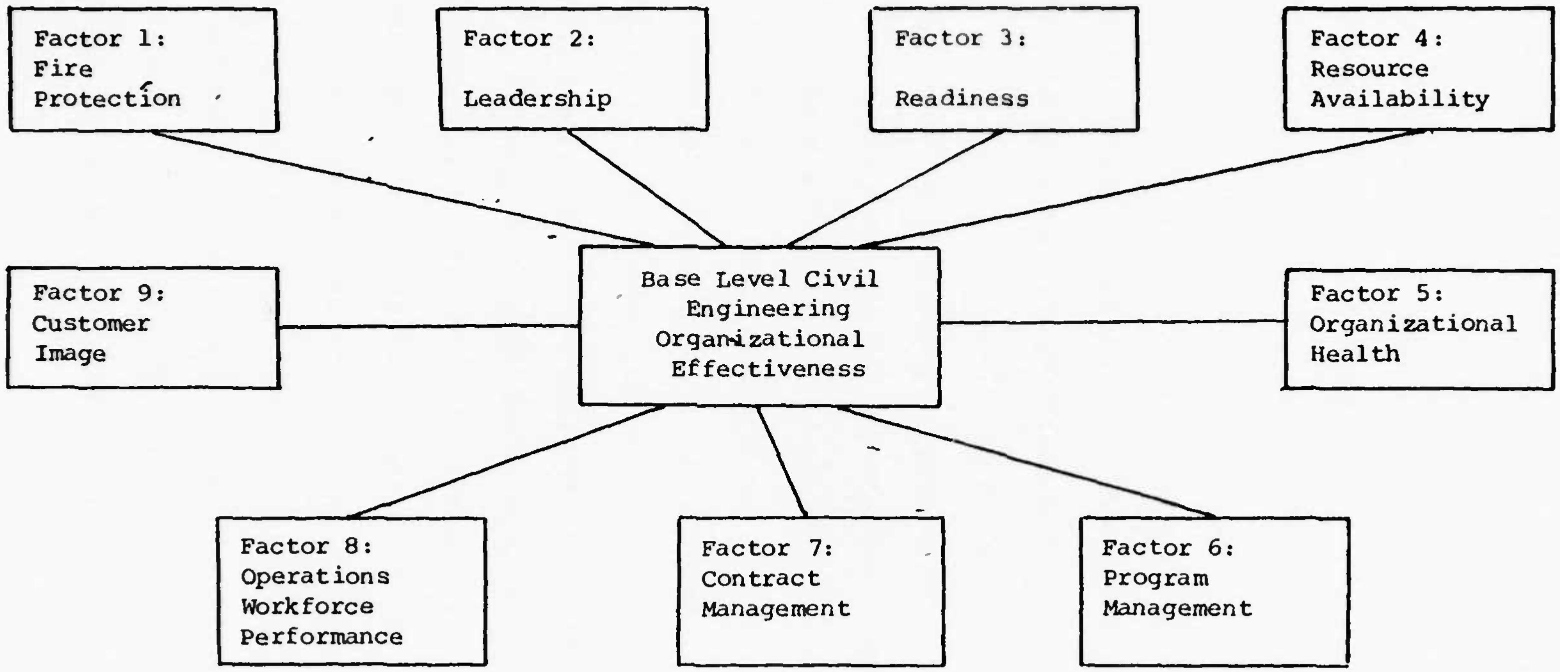

Fig. 6.1. Functional Model of Organizational Effectiveness

unit OJT programs to be significantly more important in defining organizational effectiveness than do base commanders.

Differences in perceived importance also exist based upon the command and upon the size of the installation. These differences were presented in Tables 5.4 and 5.5, respectively (pages 104 and 107).

4. Regardless of the respondent, the leadership demonstrated by the base civil engineer and his/her subordinate supervisors is the single most important criterion in defining organizational effectiveness within base level civil engineering organizations.

5. It is interesting to note that as the level of command increased, the perceived effectiveness of the CE organization decreased. That is, base commanders in general perceived the effectiveness of their civil engineering organizations to be lower than did base civil engineers. Wing commanders, in turn, perceived even lower levels of organizational effectiveness than did base commanders. However, as presented in Chapter IV, there was no statistically significant difference among the perceptions of these three commanders.

Limitations

The authors are aware of specific limitations in this research effort. Although these limitations do not negate the results of the study, they should be considered by researchers contemplating follow-on research.

1. The most significant limitation concerns the survey questionnaire. The five-point Likert scale used to rate the perceived importance of each criterion restricted the dispersion of the responses, resulting in a narrow range of data and limiting the application of factor and regression analysis. Future researchers should consider a wider scale (perhaps seven or ten points) than that used in this study.

2. Wording of the questionnaire restricted responses to perceived levels of importance. Few criteria were identified as unimportant in defining organizational effectiveness. A better procedure might have been to initially ask if each criterion was or was not important in defining organizational effectiveness. For those criteria perceived to be important, a second question could have asked for the perceived level of importance of that criteria.

3. Although the return rate for the survey questionnaire was high, and supports the researchers' assumption that the results are representative of the populations' views, only a complete census of the population could provide absolute certainty. This is considered to be a minor limitation of this study.

4. Because this study was concerned with CONUS installations only, the results cannot be assumed to be valid for overseas installations.

Recommendations

Specific recommendations offered for consideration as a result of this study are presented below.

1. The School of Civil Engineering, AFIT, Wright-Patterson AFB, Ohio and senior civil engineering leaders at all levels within the Air Force should emphasize to base civil engineering personnel those criteria and factors perceived to be important in defining organizational effectiveness within base level civil engineering organizations. Special emphasis should be placed on those criteria perceived more important by base and wing commanders than by base civil engineers. This recommendation can be achieved through the following actions:

a. Brief the results of this research to the commanders attending the Commanders' Orientation Courses at Wright-Patterson AFB, Ohio and Maxwell AFB, Alabama.

b. Provide a copy of this report to each base civil engineer in the CONUS.

2. Further research efforts should concentrate on the three steps remaining to complete this project as requested by the Air Staff:

a. First, standardized definitions must be determined for each of the nine factors within the functional model presented.

b. Next, research efforts should focus upon developing measurement criteria for each of the nine factors.

c. Finally, using the measurement criteria developed from these additional research efforts, investigators should test and validate the model for use by base civil engineers at CONUS Air Force installations.

3. If the model proves applicable, it should be proposed for use at all CONUS installations.

APPENDICES

APPENDIX A

POTENTIAL SURVEY POPULATION

	Base	Wing Commander	Base Commander	Civil Commander
1.	Altus AFB, OK	x	x	x
2.	Andrews AFB, MD	x	x	x
3.	Barksdale AFB, LA	x	x	x
4.	Beale AFB, CA	x	x	x
5.	Bergstrom AFB, TX	x	x	x
6.	Blytheville AFB, AR	x	x	x
7.	Bolling AFB, DC		x	x
8.	Brooks AFB, TX	x	x	x
9.	Cannon AFB, NM	x	x	x
10.	Carswell AFB, TX	x	x	x
11.	Castle AFB, CA	x	x	x
12.	Chanutte AFB, IL	x	x	x
13.	Charleston AFB, SC	x	x	x
14.	Columbus AFB, MS	x	x	x
15.	Davis Monthan AFB, AZ	x	x	x
16.	Dover AFB, DE	x	x	x
17.	Dyess AFB, TX	x	x	x
18.	Edwards AFB, CA	x	x	x
19.	Eglin AFB, FL	x	x	x
20.	Ellsworth AFB, SD	x	x	x
21.	England AFB, LA	x	x	x
22.	Fairchild AFB, WA	x	x	x
23.	F. E. Warren AFB, NY	x	x	x
24.	George AFB, CA	x	x	x
25.	Goodfellow AFB, TX	x	x	x
26.	Grandforks AFB, ND	x	x	x
27.	Griffis AFB, NY	x	x	x
28.	Grissom AFB, IN	x	x	x
29.	Gunter AFB, AL	x	x	x
30.	Hancock Field, NY	x	x	x
31.	Hanscom AFB, MA		x	x
32.	Hill AFB, UT	x	x	x
33.	Holloman AFB, NM	x	x	x
34.	Homestead AFB, FL	x	x	x
35.	Hurlburt Field, FL	x	x	x
36.	Keesler AFB, MS	x	x	x
37.	Kelly AFB, TX	x	x	x
38.	K. I. Sawyer AFB, MI	x	x	x
39.	Kirtland AFB, NM		x	x
40.	Lackland AFB, TX	x	x	x
41.	Langley AFB, VA	x	x	x
42.	Laughlin AFB, TX	x	x	x
43.	Little Rock AFB, AR	x	x	x
44.	Loring AFB, ME	x	x	x
45.	Los Angeles AFS, CA		x	x

	Base	Wing Commander	Base Commander	Civil Commander
46.	Lowry AFB, CO	x	x	x
47.	Luke AFB, AZ	x	x	x
48.	MacDill AFB, FL	x	x	x
49.	Malmstrom AFB, MT	x	x	x
50.	March AFB, CA	x	x	x
51.	Mather AFB, CA	x	x	x
52.	Maxwell AFB, AL	x	x	x
53.	McChord AFB, WA	x	x	x
54.	McClellan AFB, CA	x	x	x
55.	McConnell AFB, KS	x	x	x
56.	McGuire AFB, NJ	x	x	x
57.	Minot AFB, ND	x	x	x
58.	Moody AFB, GA	x	x	x
59.	Mountain Home AFB, ID	x	x	x
60.	Myrtle Beach AFB, SC	x	x	x
61.	Nellis AFB, NV	x	x	x
62.	Norton AFB, CA	x	x	x
63.	Offutt AFB, NE		x	x
64.	Patrick AFB, FL		x	x
65.	Pease AFB, NH	x	x	x
66.	Peterson AFB, CO	x	x	x
67.	Plattsburg AFB, NY	x	x	x
68.	Pope AFB, NC	x	x	x
69.	Randolph AFB, TX	x	x	x
70.	Reese AFB, TX	x	x	x
71.	Robins AFB, GA	x	x	x
72.	Scott AFB, IL	x	x	x
73.	Seymour-Johnson AFB, NC	x	x	x
74.	Shaw AFB, SC	x	x	x
75.	Sheppard AFB, TX	x	x	x
76.	Tinker AFB, OK	x	x	x
77.	Travis AFB, CA	x	x	x
78.	Tyndall AFB, FL	x	x	x
79.	Vance AFB, OK	x	x	x
80.	Vandenberg AFB, CA	x	x	x
81.	Whiteman AFB, MO	x	x	x
82.	Williams AFB, AZ	x	x	x
83.	Wright-Patterson AFB, OH		x	x
84.	Wurtsmith AFB, MI	x	x	x

APPENDIX B

SURVEY QUESTIONNAIRE

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE MANPOWER AND PERSONNEL CENTER
RANDOLPH AIR FORCE BASE, TX 78150

REPLY TO ATTN OF: MPCYPS

29 MAR 1983

SUBJECT: Survey Approval (McKnight/Parker)

TO: AFIT/LSH

Approval is granted to administer the "Survey of Characteristics Used to Define the Effectiveness of Base Civil Engineering Organizations" to military wing/base commanders and military base civil engineers. A control number of USAF SCN 83-23 is assigned and expires on 1 Jul 83.

FOR THE COMMANDER

Bert K. Itoga

BERT K. ITOGA, Lt Col, USAF
Chief, Research & Measurement Div

Cy to AFIT/ED

DEPARTMENT OF THE AIR FORCE
AIR FORCE INSTITUTE OF TECHNOLOGY (ATC)
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433

25 April 83

Dear Commander,

We are attempting to develop a management tool to allow base civil engineers to improve the effectiveness of their organizations as part of a thesis effort at the Air Force Institute of Technology (AFIT). As a senior manager, you are in a unique position to provide a critical body of information necessary for this effort. While we estimate that completion of the questionnaire should take no more than ten minutes, the opinions of experienced individuals, such as you, are essential to this effort. We intend to model a definition of organizational effectiveness based upon the characteristics you and your colleagues identify through this questionnaire.

The attached questionnaire requests your judgements concerning which criteria or characteristics define BCE organizational effectiveness. Copies of the questionnaire are being sent to wing commanders, base/combat support group commanders, and civil engineering squadron commanders at most AF bases in the CONUS.

Although participation in this survey is entirely voluntary and your anonymity will be assured, the accuracy of the model depends upon the information you provide. We will appreciate your help in completing the questionnaire and returning it in the envelope provided. Because of deadlines established by AFIT, please return the questionnaire within ten days of receipt.

Richard D. McKnight

Richard D. McKnight, Capt, USAF
AFIT Graduate Student

Gregory P. Parker

Gregory P. Parker, Capt, USAF
AFIT Graduate Student

3 Atch
1. Privacy Act Statement
2. Research Questionnaire
3. Self-Addressed Envelope

1. Please take a few minutes to complete the attached questionnaire.

2. This thesis effort will be especially helpful to civil engineering units as well as base and wing commanders in improving the effectiveness of civil engineering units throughout the CONUS; in addition, you will help the students complete a vital educational objective. Thank you for your assistance.

Larry L. Smith

Larry L. Smith, Colonel, USAF
Dean
School of Systems and Logistics

PRIVACY STATEMENT

In accordance with paragraph 8, AFR 12-35, the following information is provided as required by the Privacy Act of 1974:

a. Authority:

(1) 5 U.S.C. 301, Departmental Regulations and/or

(2) 10 U.S.C. 8012, Secretary of the Air Force, Powers, Duties, Delegation by Compensation, and/or

(3) DOD Instruction 1100.13, 17 Apr 68, Surveys of Department of Defense Personnel, and/or

(4) AFR 30-23, 22 Sept 76, Air Force Personnel Survey Program.

b. Principal purposes. The survey is being conducted to collect information to be used in research aimed at illuminating and providing inputs to the solution of problems of interest to the Air Force and/or DOD.

c. Routine Uses. The survey data will be converted to information for use in research of education related problems. Results of the research, based on the data provided, will be used by curriculum planners and may also be included in published articles, reports, or texts. Distribution of the results of the research, based on the survey data, whether in written form or presented orally, will be unlimited.

d. Participation in this survey is entirely voluntary.

e. No adverse action of any kind may be taken against any individual who elects not to participate in any or all of this survey.

USAF SCN 83-23

Base Size Code: A B C
(This code added for statistical purposes only; it will not affect your anonymity.)

Survey of Characteristics
Used to Define the Effectiveness
of Base Civil Engineering Organizations

Although at the time of mailing, the questionnaires were marked with an A, B, or C to indicate the size of the base, this information will be used for statistical analysis only. Your anonymity will be assured as neither this code nor your responses on the questionnaire will identify results by respondent or base.

PART I

1. What is your title? (circle one)

   A. Wing Commander
   B. Base/Combat Support Group Commander
   C. Base Civil Engineer
   D. Other ______________________________ (please specify)

2. Is a major command or numbered AF headquarters located at your installation? (circle one)

   A. Yes
   B. No

3. What command are you under? (circle one)

   A. AFLC
   B. AFSC
   C. ATC
   D. MAC
   E. SAC
   F. TAC
   G. Other ____________ (please specify)

PART II

This portion of the survey contains characteristics or traits sometimes used to define organizational effectiveness of base civil engineering units. Please indicate the importance you would assign to each of the characteristics for defining organizational effectiveness by circling the appropriate number on the scale printed to the right of each characteristic. Scale values are shown at the top of the next page.

Scale of Importance

No Comment	Of No Importance	Of Slight Importance	Moderately Important	Very Important	Essential
0	1	2	3	4	5

Characteristic	Scale of Importance
1. Number of personnel assigned versus authorized	0 1 2 3 4 5
2. Public relations effort of the civil engineering organization	0 1 2 3 4 5
3. Management of civil engineering budget	0 1 2 3 4 5
4. Supervision of the operations and maintenance work force	0 1 2 3 4 5
5. Rating of civil engineering organization by higher headquarters inspection teams	0 1 2 3 4 5
6. Use of a management-by-objectives program	0 1 2 3 4 5
7. Maintenance of family housing	0 1 2 3 4 5
8. Emphasis on energy conservation programs	0 1 2 3 4 5
9. Availability of material for civil engineering work	0 1 2 3 4 5
10. Quality of on-the-job training programs	0 1 2 3 4 5
11. Management of the housing referral program	0 1 2 3 4 5
12. Compliance with the monthly work schedule (IWP)	0 1 2 3 4 5
13. Sufficient vehicles to meet mission requirements	0 1 2 3 4 5
14. Commitment of civil engineering personnel to the goals of the organization	0 1 2 3 4 5
15. Fire protection capability	0 1 2 3 4 5
16. Fire rescue/crash capability	0 1 2 3 4 5

Scale of Importance

No Comment	Of No Importance	Of Slight Importance	Moderately Important	Very Important	Essential
0	1	2	3	4	5

Characteristic	Scale of Importance
17. Operation of utility systems (e.g., power plants, water treatment facilities, or heating plants)	0 1 2 3 4 5
18. Organizational morale	0 1 2 3 4 5
19. Use of the industrial engineer as a management consultant	0 1 2 3 4 5
20. Operation of base service store (U-FIX-IT)	0 1 2 3 4 5
21. Work force productivity	0 1 2 3 4 5
22. Accuracy of real estate management records	0 1 2 3 4 5
23. Readiness capability	0 1 2 3 4 5
24. Professional image presented by the customer service unit	0 1 2 3 4 5
25. Cooperation between branches within the organization	0 1 2 3 4 5
26. Safety program (personnel & vehicle)	0 1 2 3 4 5
27. Customer satisfaction with civil engineering services	0 1 2 3 4 5
28. Management of professional engineers and draftsmen within the engineering branch	0 1 2 3 4 5
29. Areas of base appearance under civil engineering responsibility	0 1 2 3 4 5
30. Leadership of CE commander & supervisors	0 1 2 3 4 5
31. Weekly schedule compliance	0 1 2 3 4 5

Scale of Importance

No Comment	Of No Importance	Of Slight Importance	Moderately Important	Very Important	Essential
0	1	2	3	4	5

Characteristic	Scale of Importance
32. Integrity of the recurring maintenance program (i.e., periodic equipment maintenance)	0 1 2 3 4 5
33. Accuracy of descriptions for contract work requirements	0 1 2 3 4 5
34. Identification of maintenance and repair work to be performed by contract versus in-house	0 1 2 3 4 5
35. Retention of civil engineering personnel	0 1 2 3 4 5
36. Accuracy of engineering design program	0 1 2 3 4 5
37. Airfield maintenance	0 1 2 3 4 5

(Please [1] add any additional characteristics you have used to evaluate BCE effectiveness and [2] indicate the importance of each.) (Additional space has been provided at the end of the survey.)

38. ________________________________	0 1 2 3 4 5
39. ________________________________	0 1 2 3 4 5

PART III

Using the characteristics listed above (including any you may have added) select those five you feel are the most important in defining organizational effectiveness within a base civil engineering unit. Indicate your ranking of these five characteristics by inserting their item numbers in the blanks below.

________	________	________	________	________
FIRST in importance	SECOND in importance	THIRD in importance	FOURTH in importance	FIFTH in importance

Based upon the following scale, how would you rank the overall effectiveness of your civil engineering organization? Indicate your ranking by putting an X in the appropriate box.

☐	☐	☐	☐	☐
Unsatisfactory	Marginal	Satisfactory	Excellent	Outstanding

0 20 40 60 80 100

% Effective

Please feel free to add any additional comments you may have concerning the organizational effectiveness of civil engineering units on the next page. Your assistance in completing this questionnaire is sincerely appreciated. If you would like to receive a copy of the completed study, forward your request by separate mail at the time you return the questionnaire.

Scale of Importance

No Comment	Of No Importance	Of Slight Importance	Moderately Important	Very Important	Essential

Characteristic	Scale of Importance
40. ____________________	0 1 2 3 4 5
41. ____________________	0 1 2 3 4 5
42. ____________________	0 1 2 3 4 5
43. ____________________	0 1 2 3 4 5
44. ____________________	0 1 2 3 4 5
45. ____________________	0 1 2 3 4 5
46. ____________________	0 1 2 3 4 5
47. ____________________	0 1 2 3 4 5

Additional Comments:

APPENDIX C

LISTING OF BASES BY SIZE

Small Bases

(coded A on survey questionnaire)

	Base	Personnel Strength*
1.	Blytheville	3770
2.	Bolling	2719
3.	Brooks	2410
4.	Columbus	3878
5.	England	3713
6.	Grissom	3520
7.	Gunter	1953
8.	Hancock Field	1199
9.	Hurlburt	3924
10.	Laughlin	3100
11.	Los Angeles	3310
12.	McClellan	2500
13.	Moody	3096
14.	Myrtle Beach	3551
15.	Reese	3105
16.	Vance	2700
17.	Whiteman	3551
18.	Wurtsmith	3551

*Combined military and civilian personnel assigned as reported in Air Force Magazine, May 1981.

Medium Bases

(coded B on questionnaire)

	Base	Personnel Strength*
1.	Altus	4308
2.	Barksdale	7058
3.	Beale	4630
4.	Bergstrom	4550
5.	Cannon	6154
6.	Carswell	6154
7.	Castle	5042
8.	Davis Monthan	7052
9.	Dover	6200
10.	Dyess	5440
11.	Ellsworth	6827
12.	F. E. Warren	4242
13.	Fairchild	5700
14.	George	5623
15.	Grand Forks	5585
16.	Griffis	6742
17.	Hanscom	4853
18.	Holloman	7108
19.	K. I. Sawyer	4095
20.	Little Rock	6995
21.	Loring	4038
22.	Malmstrom	4830
23.	March	5563
24.	Mather	7000
25.	Maxwell	6257
26.	McConnell	4811
27.	McChord	7406
28.	MacDill	4830
29.	Minot	6236
30.	Mountain Home	4888
31.	Pease	4125
32.	Peterson	4443
33.	Plattsburg	4360
34.	Pope	4453
35.	Seymour-Johnson	5990
36.	Shaw	5708
37.	Tyndall	6448
38.	Williams	4370

*Combined military and civilian personnel assigned as reported in Air Force Magazine, May 1981.

Large Bases

(coded C on survey questionnaire)

	Base	Personnel Strength*
1.	Andrews	8596
2.	Chanutte	9200
3.	Charleston	8748
4.	Edwards	8494
5.	Eglin	13265
6.	Goodfellow	14070
7.	Hill	19599
8.	Homestead	7680
9.	Keesler	17376
10.	Kelly	22770
11.	Kirtland	16966
12.	Lackland	24751
13.	Langley	11000
14.	Lowry	13852
15.	Luke	8000
16.	McGuire	7590
17.	Nellis	10282
18.	Norton	8194
19.	Offutt	14574
20.	Patrick	9978
21.	Randolph	7886
22.	Robins	19105
23.	Scott	9836
24.	Sheppard	11198
25.	Tinker	24200
26.	Travis	11370
27.	Vandenberg	14320
28.	Wright-Patterson	23900

*Combined military and civilian personnel assigned as reported in Air Force Magazine, May 1981.

APPENDIX D

INPUT DATA

DATA FILE FORMAT

Record Number	Base Size Code	Position Code	Headquarters Code	Command Code	Criteria Levels of Importance	Number of Additional Criteria Suggested	First Most Important Criteria	Second Most Important Criteria	Third Most Important Criteria	Fourth Most Important Criteria	Fifth Most Important Criteria	Perceived Effectiveness of Local CE Organization
100=001	C	C	A	A	444543425334554454424445544454545454454	2	9	5	5	38	39	70
110=002	C	C	B	A	545534445534555555425455554545454455555	2	30	14	4	28	9	50
120=003	B	B	B	A	445533454344444544334354444444544444444	0	23	30	3	4	8	50

```
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110=002 C C B A 5455344455345555554254555545454455555  2 30 14  4 28  9 50
120=003 B B B A 4455334543444445443343544444454444444  0 23 30  3  4  8 50
130=004 B B B C 4345334444434555454343445444453344444  1 30 18  4 25 14 70
140=005 C B A F 5555335355335555555345455555555345555 2 35 36 38 39 37 90
150=006 A C A A 5454434354334445543243544444354333334  2 30  3  9 17 16 70
160=007 A A B D 4454445454345455443344444444453454444  2 30  3  9 33 15 90
170=008 A A B C 4455335444234555553354544545454455555  4 30  3  4 21 14 70
180=009 A B B C 4354420454444555554444545554454444445  0 30  3 26 23 14 60
190=010 C C B D 2335455353244555553253555355554555444  0  4 29 25 21 18 50
200=011 A C B F 5555444554434545554454545555555444554 5 0 30 14 18 23 25 90
210=012 A B B F 4545424244444555453553454454554454455  2 38 39 21 30 29 70
220=013 B C A F 4554424354434455443344554544453343344  0 30 23 16  3  2 70
230=014 A B B F 4255334344333455544343544444353444445  0 30 23 21 33 34 70
240=015 C B B D 5454335544544555454454554554454454455  0 23 27  7 18 30 90
250=016 B C B F 4454524454345544442344454454453344444  0 30  5 13 14 27 90
260=017 B C B E 4555554455335544454452555554454454544  2 39 23 30 18 27 50
270=018 C A B D 4354433344234455443043533443443443434  0 23 15 16  3  5 60
280=019 C C B D 2354335254335555555414455445345434544 5 0 30 18 14 23  9 90
290=020 C C A D 4455234354334544453342445445453454454  7 14 18 30 13  9 70
300=021 C A B F 4345343344344445554244444444345443344 4 2 14 12 17 18 25 70
310=022 C B B F 4430224353435455452443224454553543344  1 38 16  5 27 13 90
320=023 B B B D 5455335555455555554453555555455554355  0 30 21 23 12 33 90
330=024 B A B D 4255323433332333344343433433353433333  0 30  4  3 21 26 90
340=025 B B B C 5455334345433544555454545454454555554  1 38 35 36 37    70
350=026 C A B A 4355335555345555553455555555555555455  2        .       90
360=027 A C B F 4545314443334544452452555555553443454  4 38 14 18  2 21 70
370=028 B A B C 3444334445344555445354544544453444354  1 38 21 30 10 14 70
380=029 C B A D 4354333254334355443343344534454443344  2 16 15 30 26  9 70
390=030 C C A D 4345323253235455533244534544343444445  0 23 26 16 17  9 50
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410=032 A C B D 4355334444334445544443444445445443344 4 0 30  4  3  5 17 70
420=033 C B A A 4344434454344444543353445344454444345  0 30  9 25 23  3 70
430=034 C C B F 5455315555555555554555555555553555555  1 29 13 30 36 12 90
440=035 C C B C 4554213443245544455245555353245333444  1 14 25  2 27 18 70
450=036 B B B E 4355314454344555444244544454454455354  0  5 23  1 30 33 90
460=037 B C B D 4455124555234535443353545554444345444 5 0 21 25 10  9 23 90
470=038 A B B F 4555434344444555543454455445554554455  0                50
480=039 B C A G 4544333453335555452144445453453444545  2 25 30 18  2 27 70
490=040 B B A F 4454324243433555442253534334353453355  3 30 16 23 21 15 90
500=041 A D B F 5355343354234544453354444444353443344  0 30 18 21 14  9 50
..
```

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530=044	A	A	B	E	445434444434445544423344443344444443444	1	3	14	36	15	16	75
540=045	A	A	B	E	4355304345434555553355545554454454455	2	23	30	14	4	18	70
550=046	C	A	A	E	4455335455435555555554554555555555455	1	16	17	33	37	26	70
560=047	A	D	B	C	5555415555534533543453445454454445445	2						70
570=048	A	B	B	C	2454320355334355543343345425453454430	0	16	15	17	25	3	50
580=049	A	C	B	F	4555234455335555543344545454443544545	2	14	4	9	10	23	70
590=050	A	B	B	C	4455424455444455444344444444444444444	0	4	9	10	3	21	88
600=051	B	A	B	D	54544444544445555453445455544454454445	0	30	14	3	19	23	70
610=052	A	B	B	F	53454354543455455544454444444454545555	2	21	30	14	35	32	90
620=053	C	D	A	B	32555332432535555531525553545555533344	0	18	21	25	14	3	90
630=054	A	C	A	F	44553245543445555544354045444354455450	2	30	14	21	3	9	70
640=055	A	B	B	E	45544344443344555544343444544454444445	0	30	3	28	4	18	70
650=056	B	A	B	D	54554355554455555444444545544454444545	2	30	23	37	1	14	90
660=057	B	B	B	D	43543345443454555544343445545454544455	2	30	3	28	15	36	90
670=058	A	A	B	E	5355245355244555554353535555554443455	0	14	1	4	28	30	70
680=059	A	B	B	E	45554354543355555543454545544453444555	0	4	3	17	21	27	70
690=060	A	C	B	E	55555354555455555554555555555554555455	3	40	38	18	21	4	70
700=061	B	A	B	F	43553344543454444333434434444444444344	1	3	4	9	30	34	90
710=062	B	A	B	E	33553334453335454443435444454454454544	1	38	23	10	5	4	50
720=063	A	B	B	A	4455345454344555554454555444454554445	1	30	14	18	21	23	70
730=064	B	A	B	E	4243323244134444431332433333344444323	0	30	1	3	14	9	70
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750=066	B	C	B	B	5455324353435553532233445454454444430	2	39	38	27	9	30	70
760=067	B	C	B	E	4455335454345455554454355444454454444	4	40	3	38	18	4	70
770=068	B	B	B	E	4553245344345544344453454555454353453	2	38	39	21	28	18	0
780=069	B	C	B	C	5454534344334455443254445454553444445	0						70
790=070	B	A	B	E	3355340245234555542252555444453455445	2	30	23	21	4	10	70
800=071	C	B	B	C	44554255544454555544345554444444554445	2	39	38	15	11	30	90
810=072	C	C	B	F	44443233433245555443452545434554333344	2	38	14	21	23	30	70
820=073	B	B	B	C	54453344544455554433434455444453443345	2	30	14	4	25	1	45
830=074	B	C	B	E	3434454455334445434344555443254544445	1	30	6	25	9	32	70
840=075	B	B	B	D	3354334455434344444333544344443333445	1	23	38	10	9	3	90
850=076	C	A	A	D	535420224325453334425245345444344344	0	27	24	21	12	3	70
860=077	B	A	B	E	35553243444435554543534554444454444444	2	30	21	14	0	4	60
870=078	B	C	B	E	44554444554455555544054445545454455455	4	30	25	14	21	3	50
880=079	B	A	B	E	44443044504444554400434444444443444444	1	30	5	4	14	25	50
890=080	C	C	B	C	5345334454445455553143435435354444345	1	30	4	9	16	17	90
900=081	A	A	B	C	32552353555244455442244444433454442445	0	30	4	3	9	10	70
910=082	A	C	B	C	5345313255435555454132554534453433445	9	38	30	23	41	10	70

..

920=083	A	B	B	C	44443244454444445433445344544544544 54	2	10	38	23	30	27	70
930=084	B	A	A	F	42444443433444333433434344444455444444	1	38	35	36	37	0	70
940=085	B	B	A	F	54552453555555344424544444455455454444	1	14	28	4	7	12	50
950=086	B	C	B	E	54553254543355555433445445454544454455	2	30	4	33	3	16	90
960=087	B	B	A	E	42553033333344345433443343444444354445	1	3	4	17	37	33	50
970=088	B	A	A	E	33443343444455445533434454544453553444	0	14	30	33	27	18	50
980=089	C	C	A	B	32442354543353554433332335333334443235	0	15	16	37	7	9	70
990=090	B	C	B	D	34453243542354444522535545545534 54445	3	38	5	18	9	13	90
1000=091	C	B	A	C	44553454543444555444544444444544454455	0	21	10	33	0	0	50
1010=092	B	B	A	F	54554455545555555555545555555555555455	0	21	19	9	1	7	70
1020=093	A	C	B	C	45442334532355445531524544544443545345	2	2	21	9	33	24	70
1030=094	B	B	B	E	34553343444445555534535544445555545445	1	0	0	0	0	0	60
1040=095	B	B	B	D	54542335543345554442535544453535555455	1	30	18	34	21	35	90
1050=096	A	C	A	B	03453243504300005442540434504435542 50	1	4	9	32	33	21	50
1060=097	A	B	A	B	44443342443334304433531332433444543 30	0	21	33	30	32	34	50
1070=098	B	A	B	F	44554544454444555554454555554554454445	0	30	14	10	18	21	90
1080=099	B	B	B	F	55543444544445555445444445445544444 54	0	30	14	3	2	20	70
1090=100	B	D	B	F	45332142533244444455435544545433323 34	0	23	9	29	19	20	70
1100=101	B	C	B	F	45553455555355555553545555555555544545	0	30	3	14	27	2	50
1110=102	C	A	B	F	54455343443544554554545445555554555 55	1	37	33	34	21	28	90
1120=103	C	A	B	C	42543244542354450433435343404534004 43	0	0	0	0	0	0	70
1130=104	B	B	B	E	55553453554445554534545555545544534 54	0	0	0	0	0	0	90
1140=105	B	C	B	D	33554554544455555453445455444545445 45	0	30	17	37	14	23	90
1150=106	B	C	B	E	55454253455454555433424454554544555 54	2	39	1	30	28	14	70
1160=107	C	B	B	F	43331034453334444402405344403533434 03	1	30	23	10	1	14	70
1170=108	C	A	B	F	53554454554444550534544455444544444 45	0	30	3	4	21	18	70
1180=109	C	D	B	F	45554203550055000500405055444534404 44	3	30	40	14	23	18	70
1190=110	B	C	A	F	43445433533355442424425433534422333 44	0	23	27	5	9	14	70
1200=111	B	C	A	E	44554343444445555433545554555454454 55	0	21	23	27	4	28	70
1210=112	B	A	A	E	43544244453544444452445345544554554 45	2	3	12	39	10	30	40
1220=113	B	C	B	F	44453243542355454533525454544534334 45	3	38	30	9	4	23	70
1230=114	B	A	B	F	44443344434444444443443344444444444 44	0	4	1	17	35	9	70
1240=115	B	C	A	E	55355253555355555434535454545544554 55	3	30	39	38	14	40	50
1250=116	B	B	A	E	54554354543455555544545444455545545 55	2	21	3	5	30	14	40
1260=117	B	C	A	E	42331322432344444532423454533533243 33	0	18	25	32	30	21	90
1270=118	B	C	B	D	44553355454454555434435545545545534 55	0	37	27	4	30	23	70
1280=119	C	C	B	C	43444133433234450412434343444423433 40	0	0	0	0	0	0	70
1290=120	C	B	B	C	55550153545445554521545533535543344 54	0	30	4	14	18	35	90
1300=121	C	C	B	C	54343244443354555441445445445535335 40	6	23	1	5	30	32	90
1310=122	C	B	B	C	44554244554454555433445444444544444 44	0	30	9	23	3	4	70
1320=123	B	B	B	E	54543054543454554440434445454544455 44	0	30	1	28	35	9	90

••

1330=124	B	C	B	C	5455334444334455453244544443343444444	0	18	23	1	3	30	70
1340=125	B	B	B	E	4254334254435555443343344344443353443	1	3	13	14	9	33	70
1350=126	B	A	B	E	5455345345233455542344454543454454245	2	30	38	37	4	7	70
1360=127	B	A	B	E	5255334355434555554253544554453555444	0	14	1	15	18	3	50
1370=128	C	C	B	B	4355235254234555354242555433343443344	0	14	18	23	25	7	90
1380=129	C	B	B	C	5554445444445555553545555555554555351	0	18	1	2	19	23	50
1390=130	C	C	A	F	5455224454235555553352445444454444445	0	30	18	25	4	14	70
1400=131	C	A	A	D	4455334544333555544354544445344454345	0	4	21	3	8	33	70
1410=132	B	A	B	D	5255234554435555444243534544453454445	0	23	9	30	0	26	90
1420=133	C	D	A	A	4355433454234545342253555354553455454	2	38	39	21	30	34	50
1430=134	A	B	B	C	4554324545534455534343445444453344455	0	0	0	0	0	0	70
1440=135	A	C	B	C	4545424454444555554344555455454544544	0	30	25	18	14	24	70
1450=136	C	B	B	E	4355444454444545553334454454345434445	2	30	17	23	15	3	90
1460=137	C	A	A	C	5555334455244455533344544544444454455	0	14	25	3	27	36	50
1470=138	B	A	B	E	4455455444333555544453533554455555455	10	21	30	3	23	6	30
1480=139	B	C	B	F	5544334345335535443342534553353333433	2	38	39	27	23	26	60
1490=140	A	B	B	B	2433123342233430333242444354433322220	0	27	21	14	29	24	50
1500=141	A	C	A	B	4444434444334444443343544543453343445	2	39	30	5	26	3	50
1510=142	B	B	B	E	4255345343244544433250333244354353334	0	21	30	4	14	7	50
1520=143	C	C	A	D	4545344455435455544354545544454445445	0	30	4	10	23	2	70
1530=144	C	B	A	D	4345354354344455443353344443454444444	0	30	4	21	9	6	70
1540=145	B	C	B	F	4345324354434444444442544444553234333	0	30	4	9	23	29	70
1550=146	C	D	B	B	5345324455245555540340545554454343445	1	35	15	23	30	17	70
1560=147	C	A	A	C	5355334443342534444252544344353342343	0	21	30	23	4	3	30
1570=148	B	A	A	G	4455434445444555543343555545454454455	0	30	3	4	21	12	50
1580=149	B	B	B	E	4455334344334455544253554544444444445	0	21	4	3	23	17	70
1590=150	C	A	B	E	5355433344244444540353333343354454454	1	30	21	3	1	38	90
1600=151	C	B	B	B	5334324353433455553332434433553343544	0	1	18	30	15	29	90
1610=152	C	C	B	E	5445325455435455544344444544454355445	0	30	4	34	9	13	70
1620=153	B	C	B		5444334453445455452344445444454444555	2	30	18	1	9	13	90
1630=154	A	A	B	F	4435224254145555443553444444454444444	0	30	14	9	31	4	50
1640=155	A	B	B	E	4354435444335455443343444444554444354	1	30	29	3	13	1	70
1650=156	C	A	A	A	4455335555545555554454455554554444444	0	0	0	0	0	0	70
1660=157	A	A	B	F	5455344454235545443453444554553444455	0	30	14	21	1	4	70
1670=158	C	C	A	E	5455433454334555553343435444454434445	3	1	5	30	18	14	70
1680=159	C	C	B	B	5555315354335545452554344444353444545	8	30	21	2	9	7	90
1690=160	B	A	A	F	5345045555534555445554455544554444454	1	30	10	6	3	12	70
1700=161	B	B	B	E	5355334454334555532353534545553354455	2	21	14	30	37	3	70
1710=162	A	B	B	D	5555455555555555555455555555555554555	0	30	18	21	27	16	90
1720=163	A	A	B	C	3445224455355555345554544445454443345	2	39	38	30	14	21	50
1730=164	C	A	A	F	5254334344334435453443454344554344354	1	30	38	36	3	18	90

..

```
1740=165 C B B D 43544344543444444433434444444453343444  2 30  3  9  4 21 50
1750=166 B A B C 44543244433434554423445445434443444445  0 27 23 14  7 29 50
1760=167 C A A D 54543245342244454533435555445533353445  0 23 18 25  3 26 70
1770=168 B C B E 54452243442354550440532554343553444355  0 21 30 36 37 16 70
1780=169 B A B E 53553244552244554430435345444544444445  0 30  3 15 16  4 50
1790=170 B B B E 34543332554454555433445445434533443345  1 30 23  3 10 15 50
1800=171 C A B C 44543144343334554433444444444454333434  0 30 14 21  4  3 90
1810=172 A A B D 53552453553344555523524453535433543345  0  1 21  4  3 29 70
1820=173 C A A D 54453453445435445544534454555544555455  2 21 29 18 30 27 50
1830=174 C B B A 45553444444445555534444454444453044345  1 30 25 18 32 38 70
1840=175 B A B E 43543353354444555543545445554154554555  0  3 21 16 15 10 90
1850=176 B A B D 45444544444334555454444554555445343 3445  2 36 39 37 35 36 90
1860=177 B C B E 34553353553345445423425554444543434444  3 30 38  3  7  5 70
1870=178 B C A E 55550344555355555440545555554545555555  2  0  0  0  0  0 70
1880=179 B A B E 44553354553455334544534454544534555550  2 30 14  4  3  9 50
1890=180 B B B F 43443443433434555333435444434443434445  0 15 16 17 23 37 70
1900=181 B A B F 43344343334335333434433422444422433332  0 30 14 20 21 27 50
1910=182 B A A E 44544243443434555454444534444453444444  0 30 18 23  3 16 50
1920=183 C A A D 54553453443545444424533434444545535555  2 35 33 38  3 30 40
1930=184 C D A C 45444315254435555453542255353552244244  0 14 25  2 30  9 50
1940=185 C A A B 43544344554444554434555444444545444445  2 30  3 38 23 21 90
1950=186 B A B E 53554344453355444433535444444454444445  0 30 23 21 10  3 50
1960=187 B C B E 44543343443344444443243455444354335345  6  0  0  0  0  0 70
1970=188 B A B E 43443233443344444443243434444445344444  0 30  4 14  9 21 70
1980=189 B B A E 55453242333455554532424354454544355 44  1 38 14  4 30 25 50
1990=190 A C B C 53455254544335554530425455433444443445  0  9 14  1 25 23 50
2000=191 B B B E 44553343443445555534534543545544455455  0 30 18 21 14  4 50
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2020=193 B A B E 54555155555455555544555455454545553455  1 30 14 21 18  3 90
2030=194 C B A A 33443343543343444330433333333433343333  0  9  3  4 13 30 70
2040=195 C C B A 34543344544444555423444553554544 55434  2  0  0  0  0  0 90
2050=196 C B B F 43553345544445555444444444445453444445  1 38  3 17 37 30 90
2060=197 B C B E 34553343554344555422535455443535 44345  2 30 23 15  9 10 70
2070=198 C D B C 54553344543345555443535444444454543444  0 30  3 21 23 15 90
2080=199 A A B E 33554252432435444414422234435543 55253  1 30  3 36 33  7 50
2090=200 A A B C 53453244443455555544534554545534 55555  0  0  0  0  0  0 70
2100=201 C A B C 43553244543354444433435554444533444 44  2 30  4  9 13 23 70
2110=202 A A A B 54555455555455555544545555555555554555  1 38 30  4 28 34 50
2120=203 B B B E 42554444444344554433444354444544544 44  2 38 30 25 16 39 50
2130=204 B B B F 52534244433434555433435343343534534 55  2  3 30 36 23 33 90
2140=*EOR
```

APPENDIX E

ANALYSIS OF VARIANCE

Analysis of variance (ANOVA) is a statistical technique used for simultaneously investigating the differences among the means of several populations. It is a method of estimating how much of the total variation in a set of data can be attributed to certain assignable causes (Harnett, 1982). Conceptually, the cases are divided into groups based upon the defining characteristic, and the differences in the means of these groups are compared for statistical significance (Nie et al., 1975).

In statistical terms, ANOVA tests the null hypothesis that the means of all groups are equal versus the alternative hypothesis that the mean of at least one of the groups is different or not equal to the others. If, in fact, the null hypothesis is rejected the researcher can conclude that there is a significant difference in the means of the groups. Because this is a statistical test, there can be no absolute assurance that the results are valid. That is, just because the test shows that the means are not equal, there is still a chance (probability) that, in fact, they are equal.

It is an accepted statistical practice to set the null hypothesis equal to the most conservative position (Harnett, 1982). Therefore, in the case of testing the equality of means, the null hypothesis is, generally, that the means are equal. However, there is still a slight chance that the analyst will reject the null hypothesis when it is in fact true. Because this error would erroneously imply that the condition accepted to be true was false, it is considered to be the worst type of error and is referred to as a Type I error. To guard against this, the analyst specifies a low probability of obtaining Type I errors, in all analyses. Depending upon the "cost" of erroneously rejecting the null hypothesis, this probability typically ranges from 0.01 to 0.05.

APPENDIX F

VALIDATION OF INTERVAL DATA

Traditionally, the statistical analysis data has been based upon the assumption that the data can be classified into one of four groups. Classical statistics assumes that data may be classified as either nominal, ordinal, interval, or ratio level data. Nominal level data is considered to be the lowest form of data, while ratio level data is considered the highest. The type of statistical tests which may be applied against the data are dependent upon the level of the data (Harnett, 1982).

The four traditional levels of data are distinguished on the basis of the ordering and distance properties inherent in the measurement rules. With nominal level data, numerical values may be assigned to the data, but no comparisons can be made between the data points. With ordinal level data, it is assumed that the data can be rank ordered. That is, the data can be arranged in ascending or descending sequence. Nothing can be said, however, about the relative distance between the data points. It is only with interval level and higher data that we can begin to compare one numerical value with another. Interval level data assumes an exact knowledge of the quantitative differences between the objects being measured. This type of scale is concerned primarily with the distances between those objects. With ratio level data proportional differences become significant or valuable. Ratio level data has all of the properties of the lower levels of data. In addition, ratio level data has an inherent or assumed zero point (Harnett, 1982).

As a minimum, the data from the mailed questionnaire is ordinal level data. However, parametric statistical analysis requires at least interval level data (Harnett, 1982). Unfortunately, social science research primarily deals with opinions or attitudes. Measures of responses for these attributes are difficult to classify as interval level data. A valid question then, is the appropriateness of using parametric statistical analysis on less than interval data.

Twenty-five years ago, statistical texts would have given a definitive answer to this question (Gardner, 1975). Arguments since then, however, have blurred the distinction between ordinal and interval data. Many statisticians now argue that parametric techniques for ordinal data are appropriate if the data at least approximates interval level data. Gardner (1975) concludes:

1. The distinction between ordinal and interval scales is not sharp. Many simulated scales yield scores that, although not strictly on interval strength, are only mildly distorted versions of an interval scale.
2. Some of the arguments underlying the assertion that parametric procedures require interval strength statistics appear to be of doubtful validity.
3. Parametric procedures are, in any case, robust and yield valid conclusions even with mildly distorted data.

Nie et al. (1975) go a step further and define a level of data as ordered metric or partially ordered data. This level of data falls between ordinal and nominal categories and consists of data where the intercategory distances are known even though their absolute magnitude can not be measured. Other statisticians argue that "proper assignment of numeric values to the categories of an ordered metric scale will allow it to be treated as though it were measured at the interval level" (Nie et al., 1975, p. 6). It is further argued that, except for extreme situations, interval statistics (parametric statistics) may be applied to any ordinal level data (Nie et al., 1975).

Professor McNichols (1980) argues that,

> Although there are always risks inherent in deliberately violating assumptions in statistical analysis, very few of the multivariate analysis results reported in the behavioral sciences could be justified if rigid adherence to interval scale requirements were observed. (McNichols, 1980, p. 19)

Therefore, Likert scale data is often considered to be ordered metric, and parametric analysis techniques may be used in analyzing the results of this type of data (McNichols, 1980).

The authors feel these arguments justify the assumption of at least interval level data and the use of parametric analysis techniques in this study.

APPENDIX G

FACTOR ANALYSIS

Factor analysis is a collection of techniques used to examine the underlying structure of a set of variables on which data have been gathered. It is a multivariate statistical technique that focuses on the study of interrelationships among a total set of observed variables. The objective is an analysis of the interdependence or structure of these variables (McNichols, 1980).

In the typical research application of factor analysis, researchers hope that data obtained for a large number of measurable variables result from relatively few "latent" variables or factors, where a factor is a linear combination of a number of observed variables. For example, the following relationship may occur (Boartright & McCaskey, 1978):

$$
\begin{aligned}
F1 &= a_{11}x_1 + a_{21}x_2 + a_{31}x_3 \\
F2 &= \phantom{a_{11}x_1 + a_{21}x_2 + a_{31}x_3 +} a_{42}x_4 + a_{52}x_5 \\
F3 &= \phantom{a_{11}x_1 + a_{21}x_2 + a_{31}x_3 + a_{42}x_4 + a_{52}x_5 +} a_{63}x_6 + a_{73}x_7
\end{aligned}
$$

where seven variables ($x_1, x_2, \ldots, x_7$) are grouped into three factors (F1, F2, F3).

Two primary objectives for performing factor analysis are (McNichols, 1980)

1. To identify the true dimensionality of the set of variables on which data have been gathered

2. To interpret relationships among variables in cases where a set of factors smaller than the number of observed variables is identified.

The first objective is to determine how many underlying factors might have generated the data. The principle component technique is applied to determine a factor score for each case in such a way that the values of all of the observed variables in the case can be best approximated as multiples of this factor score. These factor scores are derived on the principle of least squares as in multiple regression. If the same multiples of the factor score accurately reproduce the values of each observed variable in all of the cases, there is reason to believe that the latent property is essentially one-dimensional. This means that the property could be adequately measured by a single variable (McNichols, 1980).

The number of factors included or retained in the model is controlled by the analyst (Nie et al., 1975). However, the number of new variables (factors) retained should be based upon the following criteria (Tucker, 1981):

1. Enough factors should be retained to capture the "underlying themes" or separate patterns of the original data,

2. Sufficient factors should be retained so that a large proportion of the information in the original data is not lost,

3. The factors retained should meet the requirement of being mutually statistically independent, and

4. The resulting factors must be intuitively interpretable.

Three procedures are suggested for determining the number of factors to retain in the factor analysis model. Two of the procedures are mathematical, while the third is a graphical technique (Tucker, 1981).

In the graphical technique (Scree test), the factor analysis is first run retaining all factors. Eigenvalues are then plotted against each criteria (in descending order of eigenvalues). Frequently, this technique will show a sharp break or elbow at one or more points. The number of factors to the left of the elbow is the number of factors to retain in the model. Unfortunately, this procedure does not always present a readily interpretable result, especially when several elbows occur (Tucker, 1981).

The Upper Bound test described by Tucker (1981) is a sequential procedure which looks at the correlation matrix (residual matrix) resulting when the retained factors are removed. Factors are included in the model until the residual matrix is an identity matrix. This technique provides a maximum number of factors to include in a factor analysis model to achieve the four criteria discussed previously.

The third method for determining the number of factors to retain in a factor analysis model is the Kaiser Criterion (Nie et al., 1975). This technique retains all factors which have an eigenvalue greater than one.

The second objective in performing a factor analysis (interpretation of each of the factors) can be accomplished by examining the correlations between the values of the observed variables and the factor loadings for each factor. The factor is "most like" the observed variables (criteria) with which it is most highly correlated. The interpretation of these variables will allow identification of the factor(s) (McNichols, 1980). Although there is no absolute rule for determining which criteria to include in a factor, it is accepted practice to include those criteria whose correlation with the factor exceeds 0.4 (Nie et al., 1975).

Basically, factor analysis will define the measured or observed variables as linear combinations of an equal number of uncorrelated variables called factors. Each of the factors will contribute to explaining (reproducing) the values actually obtained for the observed variables to the greatest possible extent. The patterns of the sample correlations between each factor and all of the observed variables hopefully will allow the researcher to attach meanings to the factors (McNichols, 1980).

In this research effort, the SPSS FACTOR command with the PA2 factoring method was used to perform the principal component analysis and determine factor scores for each of the criteria. Each of the three techniques (Upper Bound test, Kaiser test, and Scree test) were then performed to determine the appropriate number of factors to retain in the model. The results of each test are shown in Tables G.1 and G.2 and in Figure G.1. Based upon the four criteria discussed earlier, the Scree test was used because it resulted in the minimum number of cross loadings (criteria included in more than one factor) and included all but one of the thirty criteria identified in research question 1. The Scree test retained nine factors which accounted for 62.4 percent of the total variation in the original criteria. Upon examining the correlations between the values of the observed variables and the factor loadings for each of the nine factors, eight factors were retained.

The resulting factors and the criteria included in each factor of the factor analysis model are shown below.

<u>Factor 1: Personnel Attitudes</u>

Criterion	Loading
2 (Public Relations)	.40982
14 (Commitment)	.50704
18 (Morale)	.53286
21 (Productivity)	.46033

TABLE G.1

NUMBER OF FACTORS BASED UPON UPPER BOUND TEST

$$H_0 = |\text{Residual Matrix}| = 1.0$$

$$\chi^2_{computed} = -[(n-1) - \frac{1}{6}(2n+5)] \ln W_{[n-r]}$$

$$W_{[n-r]} = \frac{|R|}{\lambda_1 \cdot \lambda_2 \cdot \lambda_3 \cdots \lambda_r [\frac{n - \lambda_1 - \lambda_2 \cdots - \lambda_r}{n-r}]^{n-r}}$$

where r = # of factors retained

(a) Retain 15 factors

$$W_{[30-15]} = \frac{.0000274}{7.07144 \cdot 2.31879 \ldots [\frac{30 - 7.07144 - \ldots}{30-15}]^{30-15}}$$

$$= \frac{.0000274}{29.417568[\frac{30 - 23.59662}{30-15}]^{15}}$$

$$= .326868$$

$$\ln W_{15} = -1.118$$

Therefore,

$$\chi^2_{computed} = -[(204 - 1) - \frac{1}{6}(65)] \ln W_{15}$$

$$= \underline{214.88}$$

$$\chi^2_{table} = \chi^2_{\alpha}, \frac{(n \cdot r)(n-r-1)}{2} = \chi^2_{.01,105}$$

$$= 105[1 - \frac{2}{3.105} + (-2.33)\sqrt{\frac{2}{9.105}}]^2$$

$$= \underline{82.51}$$

Since $\chi^2_{computed} > \chi^2_{table}$ Reject H_0

(b) Retain 25 factors

$$W_{30-25} = \frac{.0000274}{.03194781\left[\frac{30 - 28.74328}{5}\right]^5}$$

$$W_5 = .85500146$$

$$\ln W_5 = -0.1566521$$

$$\chi^2_{\text{computed}} = -[(204-1) - \tfrac{1}{6}(65)] \ln W_5$$

$$= \underline{30.1033}$$

$$\chi^2_{\text{table}} = \chi^2_{.01,10} = \underline{3.97}$$

Since $\chi^2_{\text{computed}} > \chi^2_{\text{table}}$ Reject H_0

(c) Retain 29 factors

$$W_{30-29} = \frac{.0000274}{.00018383\left[\frac{30 - 29.85099}{1}\right]^1}$$

$$W_1 = 1.0002735$$

$$\ln W_1 = -.00027346$$

$$\chi^2_{\text{computed}} = -[192.16667] \ln W_1$$

$$= \underline{-.05254922}$$

$$\chi^2_{\text{table}} = \underline{.000157}$$

Since $\chi^2_{\text{computed}} < \chi^2_{\text{table}}$ Fail to Reject and retain 29 factors

TABLE G.2

NUMBER OF FACTORS BASED UPON KAISER TEST

Variable	Est Communality	Factor	Eigenvalue	Pct of Var	Cum Pct
C1	.31627	1	7.07144	23.6	23.6
C2	.32302	2	2.31879	7.7	31.3
C3	.30919	3	1.95141	6.5	37.8
C4	.37497	4	1.51794	5.1	42.9
C7	.33441	5	1.38028	4.6	47.5
C8	.30016	6	1.18469	3.9	51.4
C9	.27727	7	1.15719	3.9	55.3
C10	.42110	8	1.11018	3.7	59.0
C13	.48071	9	1.03145*	3.4	62.4
C14	.52023	10	.92555	3.1	65.5
C15	.71795	11	.87661	2.9	68.4
C16	.74723	12	.84773	2.8	71.2
C17	.38748	13	.76554	2.6	73.8
C18	.35899	14	.74999	2.5	76.3
C21	.47389	15	.70783	2.4	78.7
C23	.48876	16	.65739	2.2	80.8
C24	.38132	17	.62942	2.1	82.9

*Retain factors 1-9.

TABLE G.2--Continued

Variable	Est Communality	Factor	Eigenvalue	Pct of Var	Cum Pct
C25	.42731	18	.60749	2.0	85.0
C26	.41722	19	.57601	1.9	86.9
C27	.47198	20	.54872	1.8	88.7
C28	.47899	21	.47176	1.6	90.3
C29	.35506	22	.45107	1.5	91.8
C30	.33638	23	.43238	1.4	93.2
C31	.32457	24	.41054	1.4	94.6
C32	.41975	25	.36188	1.2	95.8
C33	.48832	26	.32131	1.1	96.9
C34	.45002	27	.28247	.9	97.8
C35	.39922	28	.26134	.9	98.7
C36	.51203	29	.24259	.8	99.5
C37	.42741	30	.14899	.5	100.0

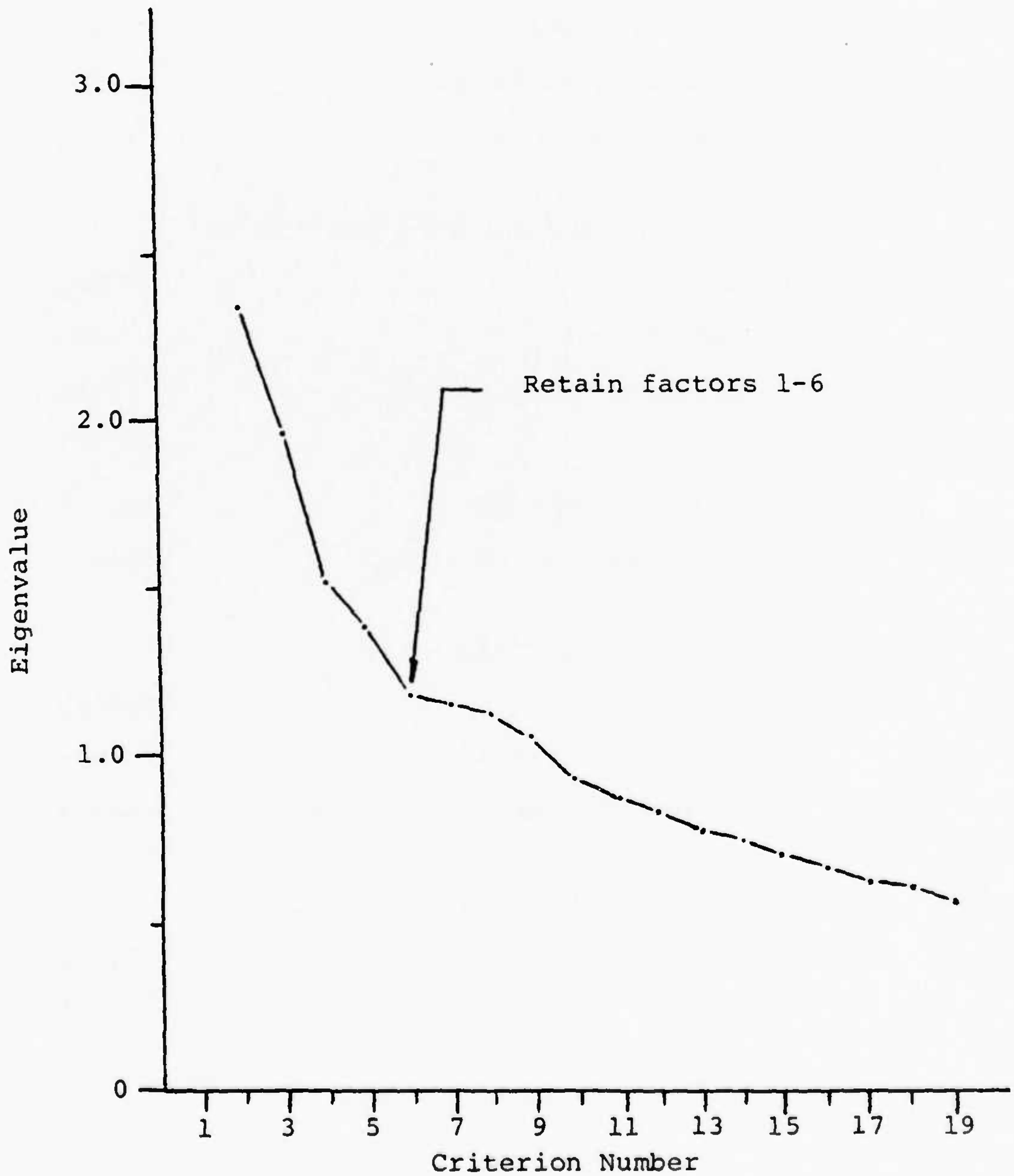

Fig. G.1. Number of Factors Based Upon Scree Test

Factor 1: Personnel Attitudes--Continued

Criterion	Loading
24 (Image)	.49524
25 (Cooperation)	.42373
27 (Customer Satisfaction)	.68610
29 (Base Appearance)	.49892

Factor 2: Accuracy of Work Requirements

Criterion	Loading
17 (Utilities)	.57651
31 (Schedule Compliance)	.41189
32 (RMP)	.45164
33 (Contracted Work)	.59278
34 (Maintenance and Repair)	.64395

Factor 3: Fire Protection

Criterion	Loading
15 (Fire Protection)	.83544
16 (Fire Crash/Rescue)	.86478

Factor 4: Internal Program Concerns

Criterion	Loading
8 (Energy Conservation)	.40977
23 (Readiness)	.65520
26 (Safety)	.52874

Factor 5: Squadron Management

Criterion	Loading
3 (Budget)	.51431
4 (Supervision)	.54395
21 (Productivity)	.40845

Factor 6: Manpower

Criterion	Loading
1 (Personnel Assigned)	.61026

Factor 7: Resource Availability

Criterion	Loading
9 (Materials)	.61227
13 (Vehicles)	.62239

Factor 8: Family Housing Maintenance

Criterion	Loading
7 (MFH)	.51735

The three additional criteria (suggested by respondents) to be included in the model were (1) responsiveness, (2) communication, and (3) recognition. Review of factors 1 through 8 suggests that communication and recognition could be included in factor 1 and responsiveness in factor 2.

Based upon this analysis, the following model defines organizational effectiveness for base level civil engineering organizations.

$$OE = f(F1, F2, F3, F4, F5, F6, F7, \text{ and } F8)$$

where:

F1 = Personnel Attitudes

F2 = Accuracy of Work Requirements

F3 = Fire Protection

F4 = Internal Program Concerns

F5 = Squadron Management

F6 = Manpower

F7 = Resource Availability

F8 = Family Housing Maintenance

Although this model identifies the dimensionality of the set of variables for which data have been gathered, it fails to combine the criteria in such a manner that the factors are intuitively interpretable. Factor 1, for example, has seven criteria which appear to deal in some way with personnel attitudes; however, the similarity between the individual criteria is not easily discernible. Interpretation of the model is also difficult because of cross-loadings. Productivity is included in both factors 1 and 5. Thus, the model created from factor analysis has limited value in this research effort.

APPENDIX H

REGRESSION ANALYSIS

Factor analysis of the thirty-seven criteria originally specified in the survey questionnaire reduced the number of independent criteria (that is, criteria having no multicollinearity) to eight. Regression analysis can now be run using these eight criteria as independent variables and the actual effectiveness ratings from part 3 of the survey questionnaire as the dependent variable to determine which of the independent variables are significant in defining organizational effectiveness within base level civil engineering units.

Linear regression analysis is a mathematical procedure used to determine the relationship between several independent variables and a single dependent variable. In mathematical notation, if we let the independent variables be represented by X_i, regression analysis can be used to determine the coefficients in the following equation.

$$Y_i = a + \Sigma(B_i * X_i)$$

It must be understood that, in terms of this research effort, Y_i represents organizational effectiveness, while X_i represents the importance values assigned to each of the independent variables or criteria obtained from the factor analysis. B_i represents the coefficients (or relative importance) of each of the independent variables or criteria in defining organizational effectiveness, while "a" represents the constant value in the equation. The reader should keep in mind that this equation will be used to define organizational effectiveness but can not be expected to actually measure organizational effectiveness since measurement criteria have not yet been established for any of the twelve independent variables determined from the factor analysis.

The first step in regression analysis is to test for a linear relationship between the independent variables. If such a relationship should exist, conceivably the factors thus related could be reduced to a new single independent variable. Such a condition is referred to as a multicollinearity of the independent variables. However, because factor analysis was used to define a set of independent variables (variables with no multicollinearity), this step has already been accomplished.

Whenever regression analysis is used, it is necessary to select an alpha or probability value that the "B" values obtained are in error and should be zero. In this research, the alpha value is the probability that an independent criterion is erroneously determined to be significant in defining organizational effectiveness. This analysis is based upon an alpha value of .05, a traditionally accepted probability of error (Harnett, 1982).

The actual regression was run using the stepwise REGRESSION subroutine of SPSS. This procedure starts with a model consisting of the dependent variable and that independent variable which is most significant in predicting the dependent variable. In addition, the subroutine prints alpha values and other statistical data for the "B" value given. By using the standard default "F" values in the REGRESSION subroutine, the program steps through the list of independent variables, adding one independent variable in each step and printing pertinent statistical data until all independent variables whose "F" values are greater than 0.001 have been added. The subroutine also eliminates any independent variables previously included whose "F" value (after inclusion of the new independent variable) is less than 0.005.

The analyst must then review each step of the procedure to decide when the number of independent variables included in the model is such that the inclusion of additional independent variables would not significantly increase the accuracy of the model. This is a judgemental decision based upon several factors:

1. The MSE (mean square of the error) should not increase with the addition of another independent variable

2. The adjusted R square (the percent of error explained by the regression equation) should not decrease

3. The "B" values for the model should remain relatively stable

4. The significance level for including a new independent variable should not exceed the alpha value established at the start of the analysis (0.005 in this case).

Once the model has been developed, it is necessary to test it against the seven assumptions for multiple linear regression models (Harnett, 1982). These assumptions and the associated tests are described in Table H.1. If any of these assumptions are violated, the robustness and utility of the regression results are reduced.

Ideally, factor analysis should result in mutually statistical independent factors that are intuitively interpretable. The factors can then be used in developing either prediction or explanatory models. As discussed in Appendix G, the resulting factors were neither intuitively interpretable nor independent (due to cross-loadings which violated assumption 7). In an effort to develop a mathematical model, the authors regressed the original thirty-seven criteria (independent variables) on organizational effectiveness (dependent variable). The resulting model explained only 9.63 percent of the variation in the dependent variable. This lack of explanatory power was most likely caused by the lack of dispersion in the dependent variable, and possibly by the failure to identify the correct independent variables. Due to these problems, the regression analysis model had limited value in this research effort.

TABLE H.1

ASSUMPTIONS FOR LINEAR REGRESSION

Assumption	Test
1. Regression is linear	Plot a graph of each independent variable versus the dependent variable. To verify assumption 1, each of the resulting graphs should have an approximately linear appearance.
2. Variance of the errors is constant	Plot values of e (error); versus Y-hat. If any pattern exists, heteroscedasticity also exists and direct application of regression analysis can not be used.
3. Covariance of the error terms is 0	Violation of this assumption is referred to as autocorrelation. The best (though not exact) test is the Durbin-Watson test.
4. Errors are normally distributed	Look at the plot of residuals included on the regression analysis (with option 11) and determine the percent of points outside two standard deviations. If this value is not too much more than 5 percent and the distribution is not too skewed, this assumption is not violated.
5. All important independent variables are included	The value of R squared and adjusted R squared should be high, but the term high is relative and can be subjectively interpreted.
6. Model fits all points	If 5 percent or fewer points on residual plot are within two standard deviations, this assumption is not violated. However, the researcher may use the Windsor Technique or trimming to correct small errors.
7. No independent variable is an exact linear combination of another independent variable	Test by instability in "B" with addition of another independent variable, or by comparing the correlation between the independent variable and all of the dependent variables with the simple correlations between each of the independent variables. If they are nearly equal, this assumption is violated and "multicollinearity" is a problem.

APPENDIX I

SUGGESTED CRITERIA AND ADDITIONAL COMMENTS

The following list contains selected additional criteria suggested by survey respondents to define organizational effectiveness. The frequency column indicates the number of times that a particular criterion was suggested. Items in the list are presented in the sequence the surveys were received. No special significance should be attributed to their order of presentation, and no distinction is implied as to the position of command or duty location of the respondent.

	Criteria	Frequency
1.	Effective Communication	10
2.	Formal Training	6
3.	Responsiveness	18
4.	Complaints	1
5.	Recognition	9
6.	Supporting the Mission	5
7.	Long-Range Planning	4
8.	Intermediate-Range Planning	3
9.	Interface with Local Community	2
10.	Rapport with Contracting Office	3
11.	Experienced Personnel	5
12.	Personnel Continuity	3
13.	Quality Control of Work	3
14.	Protection of the Environment	2
15.	Pursuit of Base Quality of Life	1
16.	Use of State-of-the-art Equipment	1
17.	Dedicated Civilian Workforce	3
18.	Good Union Relationship	2
19.	Ability to Adapt to Changing Requirements	1

Listed below are all anonymous comments received from the survey respondents. The comments have been edited for spelling and grammar only.

Wing Commander Comments

Regional consolidation of multiple base CE support into an organization reporting to a Major Command HQ, or to a DOD agency, as is now being proposed is disastrous in its effect on responsiveness, productivity, timeliness, and efficiency.

* * *

We need to groom CE Squadron Commanders like we do in the flying squadrons; i.e., ops officer, FLT Commander, etc. I strongly recommend that the deputy CE be military because all civilians tend to be loyal to the Civilian deputy vice commander because the civilians know a civilian deputy will be there year after year .... It has caused problems at this base.

* * *

We need the right number of quality people doing the work supervised by competent leaders who know how to manage people and money. Key to success is use involvement and follow-up. (Biggest weakness in the system)! All too often close monitoring of projects is left solely to QDE/CE/ contracting. I want the user/requestor to be in the equation.

* * *

The weakest link is the commanders inability to fire anyone thru the civilian personnel system.

* * *

Civil engineering is costly for the amount of production accomplished. I have not been impressed with the results of civil engineers because of the cost (manpower and supplies used and the end result). Civil engineering has not adapted to our current lean budgets. Additionally, my experience has been that the professional civil engineer has been the poorest squadron commander.

* * *

Civil engineers, military and civilian, suffer from an identity crisis. They seem to be on the receiving end much more than they deserve. Much of what they do is not readily apparent and therefore not always appreciated. Strong leadership and supervision is necessary to overcome that very debilitating affect on unit morale.

Some of my answers that were marked down in importance are not due to the fact that they are not important; it is due to the fact that we at the unit level have very little or no control over the issue. Utility conservation is a good example. We work the problem, but not nearly as hard as I believe we would if I had total control over the utility budget. Having the MAJCOM control my utility money is not the answer.

Morale impacting characteristics are most important. MFH, dormitories, work centers, MWR facilities, etc. are the visible items that CE must do well at. Balancing that requirement against the absolutely necessary items like heat plant maintenance and runway/ramp spall [small holes] repair is the trick!

* * *

Response time of our civil engineer is not good. I believe we become over programmed. I can get the job done cheaper downtown because of our bookkeeping cost system--you're pricing yourself out of business.

* * *

The questions are somewhat "motherhood."

* * *

The tendency to follow professional/technical chains-of-command through higher headquarters. This invariably results in non-identification with the primary unit mission.

The civil engineer public relations efforts are uniformly dreadful. This results in no credit being given for excellent work and usually is caused by too many CE turn downs--given without explanation. CE frequently, and very unfortunately, gets the reputation for seeking ways to get out of tasks--instead of a "can do" attitude. A commander has great difficulty protecting the CE image when they won't help themselves.

* * *

With 144 diverse and demanding tenant organizations, I live or die with the quality of our total engineering effort. I "died" with one BCE, and he's gone--replaced with a BCE who can keep all the "balls in the air."

* * *

In every civil engineering organization I have observed over 26 years, the single most often reoccurring shortfall has been civilian workforce productivity. I do not think that we get "a day's work for a day's pay" from our wage grade employees, yet we offer far greater job security in comparison to their civilian contemporaries, and we often offer better pay. Tightening productivity standards would be a "force multiplier" in maintenance, repair, and minor construction capability.

* * *

In my view--Military and civilian leadership is paramount. The base civil engineer and his military and civilian supervisors know what organizational (base/center) goals or objectives are and they have the dedication and professionalism to tackle them. They are also able to see the needs and begin planning or developing plans to correct or repair or replace the facilities, utilities, roads and streets, etc, and inform the base or center commander of the needs without having to be told what to do. The best look ahead and stay on top.

* * *

As a commander of a division whose units are tenants on TAC, SAC, and MAC bases, it is difficult to believe that we are in the same Air Force. The support given by the BCE varies from outstanding to nil. This support, while outstanding from TAC, varies from good to nil within the same command (SAC and MAC). While one BCE stands behind the command guidance for why projects cannot be accomplished, another BCE, in the same command, gets the same job done.

* * *

Housing maintenance is contracted out at this base. It is working quite well thanks to CE reducing the backlog to nil prior to contractor takeover and, subsequently, a good quality assurance program.

Base/CSG Commander Comments

Our biggest problem is an excessive number of "minimum effort" civilian employees. Some of our civilians are super but many of them do just enough to keep their jobs and nothing more. Our second biggest problem is a lack of well-qualified military managers. We have a lot of good, but low experience lieutenants, two weak/average captains, no majors, and a Lt Col commander.

* * *

Civil engineering organizations are service oriented. They must be proud of their support role. Each person, no matter how minor a task he performs, is important to the mission and must be made to feel so. Leadership, therefore, like in every other organization (military and civilian) is the most essential element in organizational success.

* * *

On a base with 35 tenants, several of which have higher ranking commanders than our host wing commander, it is essential to develop good relations with each tenant. This situation causes several problems, as each tenant CC has their own priorities, and of course wants their work to take precedence. It makes the job of a base DE very difficult. It requires re-prioritization of work--very inefficient and frustrating.

* * *

There should be a clear management information system to clearly track the productivity of the CE force. Standards of criteria are difficult to come by and, therefore, it is difficult to tell just how productive you are versus what you should be!

* * *

Technical competence, leadership over all functions of civil engineering, knowledge of regulations and engineering policies, and common sense are essential ingredients for the civil engineer. Productivity of the CE workforce must be improved. We do not get out of our people what we are paying them to do. Budget constraints have also ham-strung the civil engineers. Our bases are old, tired, and falling apart. It takes more money to keep old utility systems, pavements, and buildings going. We must also get off of this flat roof construction. Flat roofs leak!

* * *

The DE organization here at this base is doing a super job considering the constant changes in priorities. We are in a constant pressure cooker to do the very best ever done with less than many other bases--the amazing thing is that most of the critical items get completed even though we are all sure that it could be done better with proper planning. My hat's off to our CE folks!

* * *

Unfortunately, Civil Engineering is consistently undermanned and underfunded for the amount of work they have to do. Thus, the CE Commander must motivate his supervisors and workers to perform at 110%. However, CE commanders are normally engineers with little or no prior command experience. We need CE commanders, who are better leaders, better motivators, and better PR men.

* * *

CE has become so adjusted to the "knee jerk" response to new wing commanders, base commanders, and continuing budget problems that any effort at consistency of programs, any outlook for continuity of operations, or justification for remaining with a given thought for the basic future seems to get lost. I could not find a document that would help me [understand] why we are doing it this way, so that reasonable changes could be made. A realistic way of presenting what it costs to run CE day to day has to be developed. We all know you can take away then adjust, but far more reasonable decisions, with known impacts on future planning would be possible, if there were a way to say this is what it costs.

* * *

One of the most disrupting influences inhibiting good civil engineering management is the lack of knowledge, by most wing commanders, of the manning, mission, and capabilities of the unit. Command influence projects from the wing commander interfere with orderly scheduling and performance. Short suspenses and lack of patience result in work stoppages and frustration at the worker level. I recently attended the Base Commander's Management Course at Air University and was told that this is true across command lines. A better CE education <u>before</u> becoming wing commander is a must.

* * *

The best CE is a guy that is not only a professional engineer and leader but a guy who is a hard task master and demands high standards of job performance, personal appearance, and training. If he can juggle all of these, he will be successful.

* * *

The one drawback to civil engineering is their "system" which many engineers will allow to run the operation of the squadron instead of the people running the "system." Perhaps civil enginering should do what aircraft maintenance has done in TAC and get the back office people out into the everyday working situation.

* * *

CE should be manned and funded at 100% and immune to manpower cuts. Take a hard look at each organization to determine which functions should be done in-house versus contract. Increase the ratio of QAE's and improve the boiler plate for SOW's on service contracts. AFSCAG has done a disservice to the field units.

* * *

CE was the pits until the arrival of a <u>professional</u> CE commander and base commander who both wanted to see results. Civilians that have been in CE a long time can defer progress--with proper motivation--they are of significant importance. I am very proud of the progress made in the past 22 months.

<u>Base Civil Engineer Comments</u>

Q.5 on survey. This item is a report of effectiveness--as such its importance is only related to the weight placed on it by senior management; i.e., report card for the organization to highlight areas needing attention it is much more important.

Q.8 on survey. This is misplaced in a survey of CE effectiveness. We are only the messenger and our effectiveness is often erroneously linked to this program where we have minimal control.

Q.21 on survey. Work force productivity is highly important. The continual, time-consuming search for ways to measure/report/compare, etc., productivity are counterproductive and beyond unimportant, they are a drain on productivity.

Q.26 on survey. Another erroneous item. Safety is highly important; Accident/Incident rates are important and measure a unit's effectiveness. Safety programs are less important; particularly when a command/base places intense effort on proper safety programs and loses sight of safety awareness and safe practices. I have seen this on three different bases and three different commands.

* * *

The CE budget management is frequently outside the BCE's control due to other mission requirements dictating reprogramming to other units, therefore #3 is essential, but I can't rate it that high because of BCE's lack of control.

* * *

I have used three goals or MBO's to get the job done. Most of your characteristics relate to these. <u>Civil engineering facilities</u>--a good workplace for people to work will keep morale high. Pride of ownership.

<u>Awards for the unit and people, APR's, OER's, etc.</u> When you look at MEI reports, we always see that the base mission is met. That is buildings are maintained, etc. Write-ups in CE are only for not doing paperwork correctly. We are our own worst enemies in doing paperwork. So we can help resolve the paperwork problem by making sure that we do our jobs as officers to reward our people with outstanding APR's, OER's, and unit awards.

<u>Customer relations</u>--by completing jobs on time or telling the customer why you cannot do his job [you are] being honest. People will help CE with its backlog only if they know that it exists.

* * *

No comment score used because we're a total contract program (DEH is AF). Our present contract is cost plus award fee which provides a very flexible contract effort.

* * *

CE is currently losing a high percent of its productive capability due to people waiting for vehicles (instead of vehicles waiting for people). Also, the supply bureaucracy is costing as much as the supply system.

* * *

The perception of credible-professional performance is mandatory. The logistics of accomplishment must be available or no supervisor/unit will survive in civil engineering!

* * *

Responsibility for the energy conservation program should be removed from CE and be put in RM. It's demeaning to have engineers checking light bulbs and thermostats!! Engineering already has an image problem competing with rated personnel, but when also blamed for no-heat/no-cool seasons, the prestige problem becomes worse. CE should do the capital investment/design side of conservation programs but not the compliance/policeman work. Engineering bonus programs need to be expanded to all 55xx officers to improve unit effectiveness. CE needs its own contracting experts and an effective material acquisition system to improve mission support capability.

* * *

I have determined the organizational effectiveness importance as viewed by a BCE. I recognize that others may determine that some factors are of greater importance, as support to the base mission, grounded primarily in effectively insuring facilities and utilities are maintained and repaired to minimize unexpected down time. This is our primary function, not building things.

* * *

Requirements will always exceed resources, so it is essential that the base civil engineer <u>KNOW</u> the priorities of senior base leadership, as well as those of the MAJCOM and Headquarters USAF. Thus, it is an important characteristic that a free line of interchange be established at

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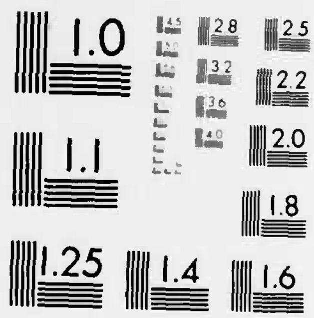

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this level. Equally important is the need to keep a free-flow of information up and down within the organization.

* * *

Too many characteristics to grade and to determine relationships. That is, productivity is dependent upon manpower and material availability. The customer is interested in how fast you can respond to his request, but it may not be essential to mission safety. Only the BCE looks closely at productivity.

* * *

We cannot follow our work schedule or do our scheduled maintenance because of diversions from commanders. They need to be educated on the importance of recurring maintenance. They just don't pay any attention to it because it is not <u>visible</u>. Wing commanders insist that <u>we do it</u> but don't understand our scheduling system. We always respond to wing commanders' desires at the expense of recurring maintenance and job orders.

CE needs to have more vehicles to do the job more efficiently. If private contractors had our job, they would probably have twice as many vehicles to get their troops around. Mileage doesn't have a legitimate place in our vehicle utilization rate.

* * *

It has been my experience that the image and orientation of the squadron far overshadow the actual work output. Clearly total dollars gained for projects and work orders completed are important. But the survival of the BCE depends entirely on the perceived positive orientation, the service oriented aggressiveness to provide assistance, and the degree of visibility shown by the top level supervisors. No matter how productive the troops, if the boss is perceived as defensive or uncooperative, then all is for naught. Further, the whole squadron product must be regularly shown to the wing staff in a concise but detailed MIS. This amounts to persuading the boss that the CES managers have a firm understanding of the key issues and criteria within the organization, and are using the data accordingly. This will also keep the heavies off the BCE's back when they see just what is being accomplished. Far too much emphasis is placed in compliance with detailed reg's; too little on forceful management of DEE, DEM, and DEF. All this adds up to a far reaching, ever active, and responsive Public Relations action on the part of the entire squadron. On a day-by-day basis, a job order accomplishment is pure politics. The grass roots folks, by way of the complaints or gripes, really shape top level opinion. Thus, one must put key emphasis on hours and quality expended to get them done. Unfortunately, this is not in the best interest of work order accomplishment. However, survival is politics; maintenance logic seldom agrees with politics. A last but no less significant area is the personal participation of the BCE to get out and look at work being accomplished, or to visit with base operations. Visibility is extremely important; the perception of "at least" interest in their problem shapes opinion. Again, PR is a main emphasis item at the top level. Development of a MIS (additional to above) is also important in that it forces supervisors and managers to at least look at their data. Only by getting out of the daily trivia and summarizing it all do they really understand the situation.

* * *

I've been a BCE for the past 4-1/2 years and am very frustrated. For me the type work I do is delightful, but the environment in which we work is the pits.

We spend about half of the base money, we are responsible in one way or another for everything that goes on on a base (e.g., facility construction, operation and maintenance, all utility systems, pavements, grounds, snow removal, grass cutting, and on and on) yet we do not have the resources (men, money, material, etc.) to do our job at a good level. We have an awful lot of responsibility but damn little authority. We either need more authority so that we can prioritize work and stay with the plan or more resources to do a better job.

Since we won't get the resources, we need more authority--i.e., work for the wing commander through a CE colonel or be separated from base authority. I recommend having an 06 working for wing commander. He should have BCE, Housing, Fire Department, and Services work for him. BCE should manage only DEE, DEM, DEU, DEA, DEI. We need somebody who knows civil engineering.

"Other" Comments

We need some way to measure the productivity, that is rational and measurable and that can be used Air Force wide (with standards). No one has ever come up with a decent set of indicators and ideal values. With the epidemic use of mini-computers someone should be able to get some true measures and come up with a good system.

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to the wing staff in a concise but detailed MIS. This amounts to persuading the boss that the CES managers have a firm understanding of the key issues and criteria within the organization, and are using the data accordingly. This will also keep the heavies off the BCE's back when they see just what is being accomplished. Far too much emphasis is placed in compliance with detailed reg's; too little on forceful management of DEE, DEM, and DEF. All this adds up to a far reaching, ever active, and responsive Public Relations

"Other" Comments

We need some way to measure the productivity, that is rational and measurable and that can be used Air Force wide

tional effectiveness. [illegible]
Academy of Management Review, 1980, 5(2), 211-217.